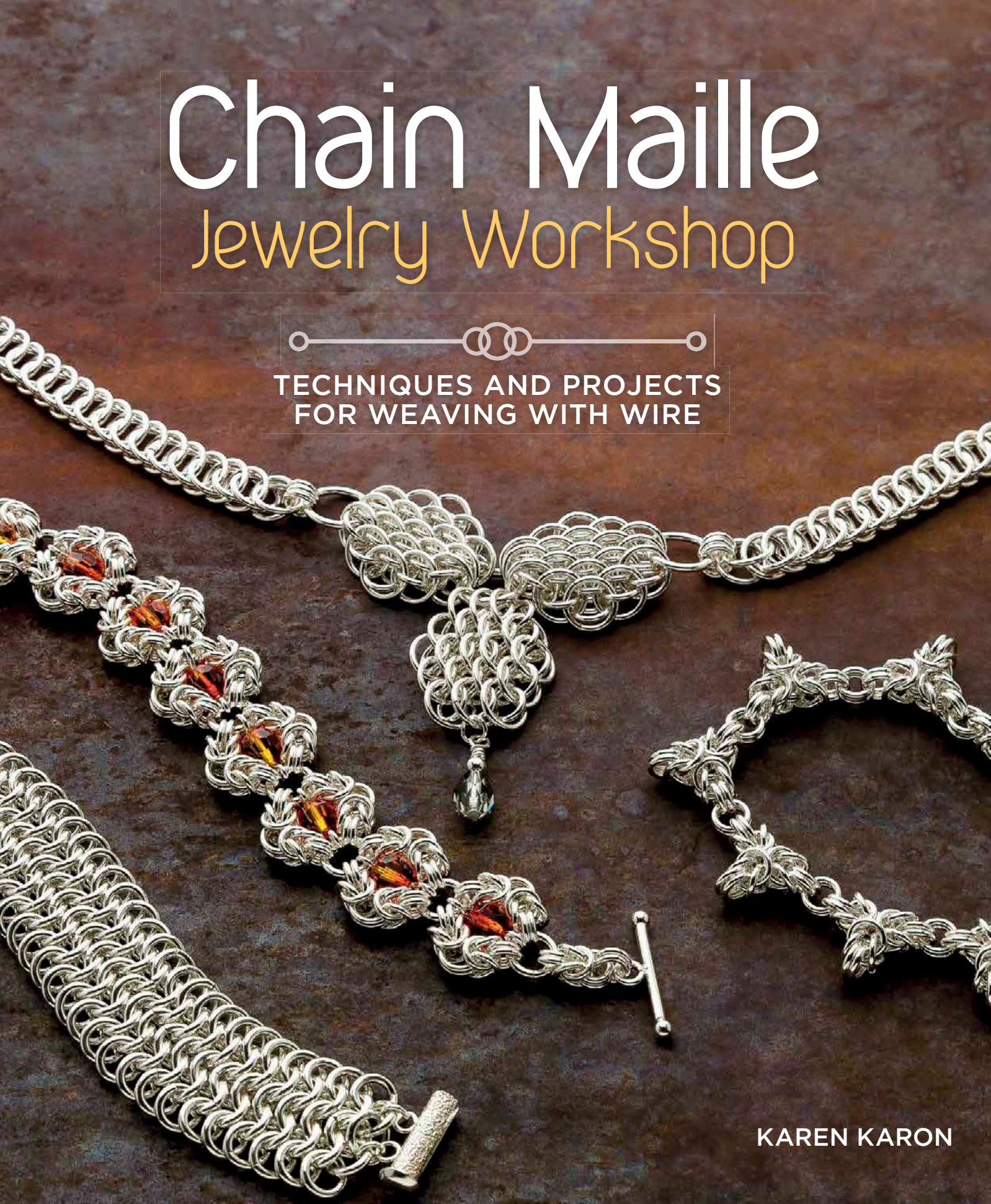
Chain Maille Jewelry Workshop

TECHNIQUES AND PROJECTS FOR WEAVING WITH WIRE



KAREN KARON

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FOR WEAVING WITH WIRE

KAREN KARON

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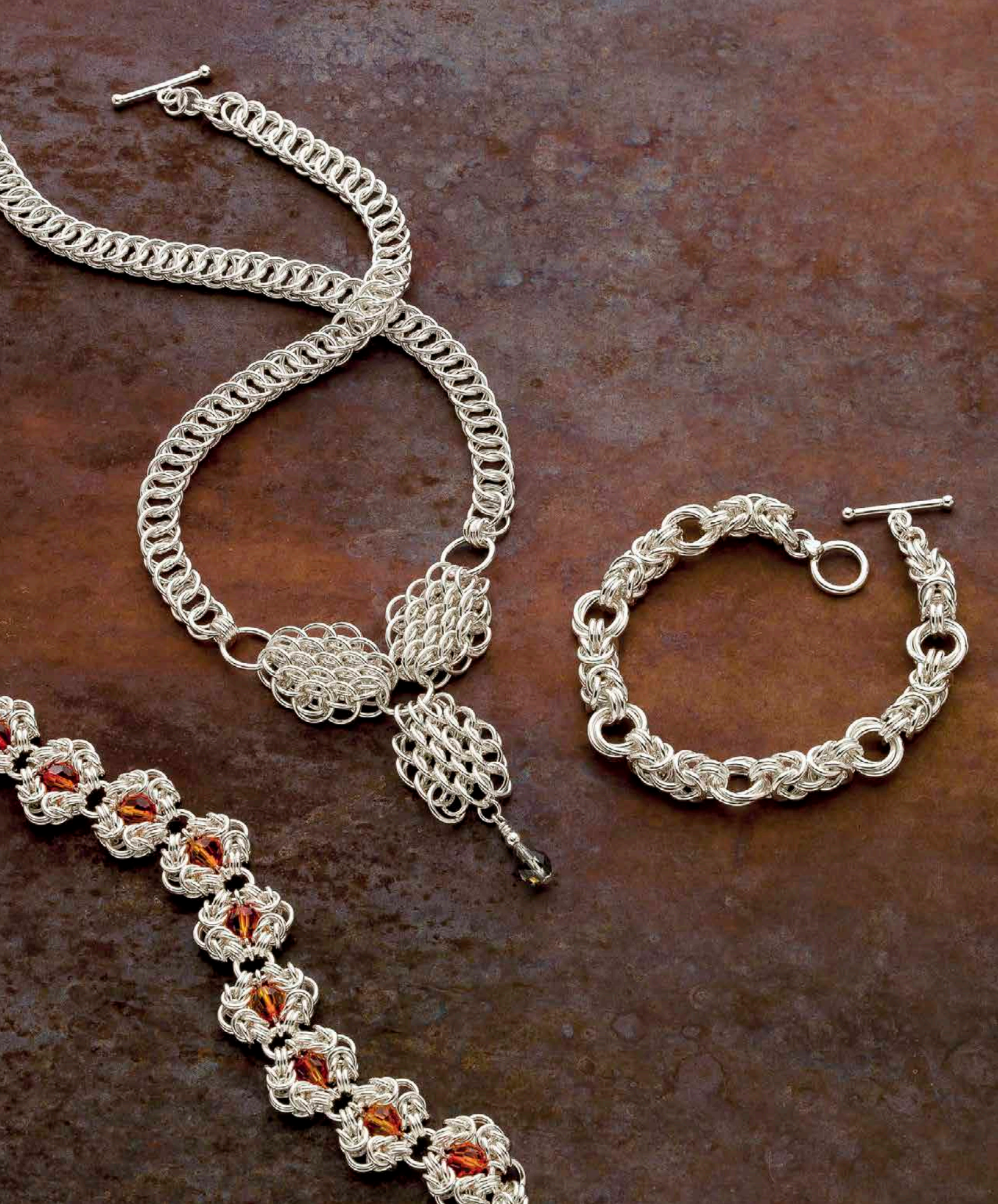


INTRODUCTION

I've always felt the need to make things. I am the oldest of three children, the quiet one, the different one, the one who'd be in the house with a pile of yarn scraps and ice-pop sticks, school glue, and construction paper. In the years since, I've tried tons of craft techniques—knitting and crocheting (still a favorite), sewing and quilting (I love fabric), polymer clay and metal clay, needlepoint, cross-stitching, tatting, decoupage, fabric painting, macramé, rubber stamping. . . . But the obsession that started it all—which eventually led to this book—began when I was just ten or eleven years old. I begged my mother to buy me a small bead loom I had seen in a local store. We didn't have a lot of money, but she indulged me anyway (thanks, Mom!). I taught myself how to use the loom and never looked back. No matter what handicraft I took up, I always returned to jewelry making. Still, it took years for me to begin using metal in my creations. The day I wove my first chain, I fell in love with chain maille.

Today I share that love with students from the New England area as an instructor at the jewelry and metal arts school Metalwerx in Massachusetts. Perhaps, like me, you've been creating handmade objects, accessories, gifts, and trinkets for years. Or, perhaps you are just approaching jewelry making for the first time. Chain maille has much to offer. You can create jewelry, objects such as bags, baskets, boxes, and bookmarks, and even clothing. (Yes, I've seen chain maille bikinis!) You can create a wonderful gift in a short amount of time. Bracelets and earrings work up in an hour or two. That sure beats quilting! Best of all, chain maille items have permanence. With proper care, items made of metals, especially precious metals, can be enjoyed for a lifetime.

HOW TO USE THIS BOOK

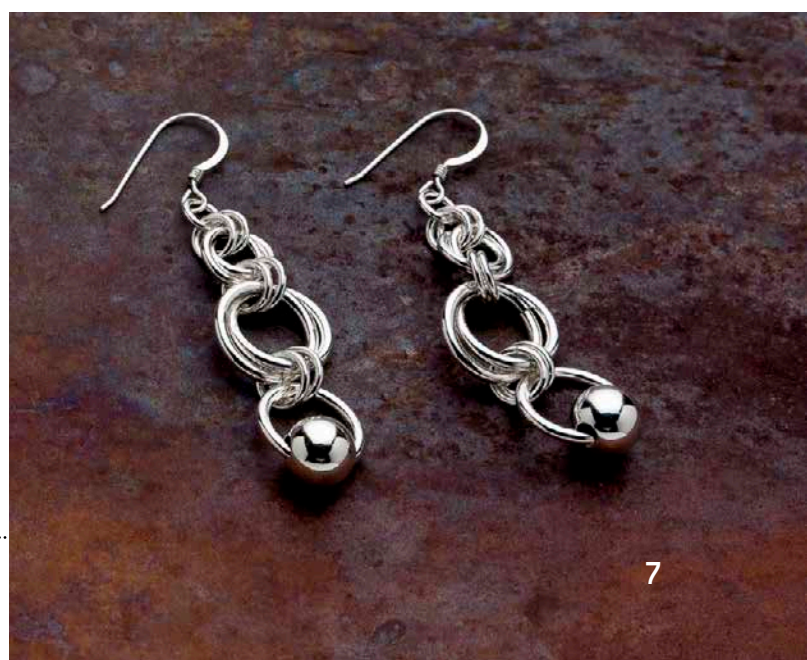
I love chain maille. For me, the simple act of interlocking jump ring after jump ring brings a quiet, meditative pleasure. Plus, chain maille projects are portable, unlike most metal arts, and the weaves just look so cool!

As a teacher (and as a student), I prefer a technique-based, workshop-like approach. In this book I have presented many chain maille weaves, along with tips, tricks, various approaches, and project instructions for each family of techniques. This is not a make-this-project-this-way type of book, although you will find plenty of design inspiration. Instead, the chapters develop skill sets in order of complexity, from simple chains to intricate Dragonscale, so you'll build your abilities step by step—and be making tons of jewelry along the way. Practicing the Byzantine weave (page 32)? Transform your chain into a slender anklet. Working on the Parallel Flower Unit technique (page 83)? Join units together using jump rings to make a pendant.

A solid foundation in chain maille techniques opens up a world of possibilities. My intent for this book is not to provide projects for you to imitate but to empower you with the tools to design jewelry that reflects your unique personality.

If you are a beginner, then you should start at the beginning. Familiarize yourself with the tools and materials in Chain Maille Basics and learn how to use them in Getting Started. At the end of the book, you'll find a list of my favorite sources so you can find the materials you'll need. Then, work your way, chapter by chapter, through the chain maille techniques; each one builds upon the others. Step-by-step instructions are accompanied by illustrations that show jump rings in assorted colors so it's easy to determine where to place the next jump ring in the weave. More experienced maillers will find a wealth of approaches to help them find just the right method for making any weave, including speed-weaving techniques to increase efficiency and alternate finishing methods and embellishment ideas to spark creativity. I've also included aspect ratio and conversion charts to make exploring a wide range of sizing options even easier.

People are always amazed to discover that the chain maille jewelry I wear has been made by hand. I hope that with the lessons in this book you'll soon be proudly accepting compliments of your own, saying, "Thanks, I made it myself."



Chain Maille Basics

Chain maille (sometimes spelled chain mail) is an ancient art form of linking metal rings together to form a fabric-like mesh. The technique dates back more than two thousand years and originated, perhaps, with the Celts. Medieval warriors wore chain maille armor in battle, and as its use spread east from Europe, slight variations developed in linkage patterns. Over the years, classic weaves such as European 4-in-1 have been expanded upon and adapted for decorative and practical purposes.

Chain maille is used still today for protective gear, such as butchers' gloves and shark-diving suits. And, of course, history buffs, Renaissance enthusiasts, and members of historical reenactment groups create faithful reproductions of age-old patterns. But chain maille also has become popular among modern jewelry makers and crafters who are drawn to its beauty, versatility, and historical significance. Today's maillers are passionate about their craft and continue to develop new patterns and techniques and to use new materials in their chain maille art.

The chain maille weaves presented in this book fall into one of three categories: chain weaves, sheet weaves, and units. Chain weaves form traditional chains, such as the Byzantine and Full Persian weaves. Sheet weaves can be expanded in length and width to produce flat, fabric-like pieces. And units are simply individual jump ring formations that can be used alone, connected to form chains, or used as decorative accents or connectors in combination with other weaves or jewelry components.

But before constructing any type of chain maille, it's important to become familiar with the tools and supplies and how to use them. Proceed with caution, chain maille is addictive!

Jump Rings

Chain maille is constructed of small rings of metal wire called jump rings. That's it! No other materials are required. You can make many styles of chain maille jewelry simply by adjusting the type and size of the jump rings you choose.

Jump rings are typically made from smooth round metal wire. However, you'll find that wire comes in many other shapes and textures, in addition to myriad metal types, colors, and sizes. All of these factors will affect the look of your chain maille.

Traditionally, iron and steel jump rings were used to produce armor, but for jewelry, most artisans use precious-metal alloys such as sterling silver and 14-karat gold, which are stronger than pure silver or higher karat gold. I've always been a silver girl, so I prefer to use jump rings of sterling or Argentium, another type of silver alloy. You can also add color using jump rings made of anodized reactive metals such as aluminum, niobium, and titanium, and with enamel-coated copper jump rings.

I recommend using aluminum jump rings when learning a new weave technique. Aluminum jump rings are less expensive than those made of precious metals, and I've found that my students feel freer to explore, experiment, and perfect their techniques before they progress to precious metals.

Regardless of what metal you choose, be sure to buy only saw-cut jump rings, which provide the flush edges needed for neat closures. Saw cuts are the standard when purchasing jump rings in precious metals from jewelry suppliers but may not be standard in all metals or from vendors that do not specialize in jewelry.

GAUGE, INNER DIAMETER, AND ASPECT RATIO

In chain maille, size matters! Each weave has an ideal size, or aspect ratio, that holds the pattern while allowing for some flex and drape. It is neither too loose nor too tight. Two factors work together to determine the ideal aspect ratio for each weave: wire diameter (WD) and inner diameter (ID). Aspect ratio is discussed in detail in Chain Maille Design 101 (page 139). Read it when you are ready for a more in-depth explanation, and be prepared to do some math!

Size begins with gauge (g), which is the diameter, or thickness, of wire. The higher the gauge number, the thinner the wire. So 16-gauge wire will be noticeably thicker than 26-gauge wire. This somewhat counterintuitive system comes from the process of making wire; metal is pulled through progressively smaller holes in what is called a drawplate. The gauge number derives from the number of holes the metal was pulled through to create the wire.

In addition to gauge, jump rings are sized by outer (OD) and inner diameter. Because chain maille is made by linking jump rings *through the inside* of jump rings, the inner diameter is the most important measurement and the one to use when purchasing jump rings for your projects.

TIP: Always be sure to have more jump rings than you need in case a jump ring gets bent out of shape or dropped and lost—it happens! I like to have at least one extra inch worth of jump rings in my supply stash.

On the surface, jump rings seem simple—just wire coiled around a mandrel and cut apart into individual rings. But every step of the manufacturing process affects the size of the finished ring, which in turn affects your finished piece of jewelry.

USING THE JUMP-RING SIZING CHARTS

Each weave in this book includes a Jump-Ring Sizing Chart that lists 16-gauge and 18-gauge jump rings at the correct aspect ratio. Take a look at the sample Byzantine Weave chart below. To use this chart, first choose a metal and gauge size: for example, 16-gauge sterling silver jump rings.

Now multiply the number of rings per inch by the number of inches you'd like to weave. A 10″ (25.5 cm) Byzantine weave will use 220 16-gauge sterling silver jump rings (22 × 10 = 220), with a 4.5 mm inner diameter.

When you're ready to explore beyond the gauges recommended in the charts, turn to page 139 to discover how to determine aspect ratio for any weave.

Sample Jump-Ring Sizing Chart

METAL	16-GAUGE		18-GAUGE	
	inner diameter	**rings per inch**	**inner diameter**	**rings per inch**
Sterling silver (AWG)	4.5 mm	22	3.5 mm	28
Aluminum (SWG)	7/32″	18	5/32″	26

GAUGE MEASUREMENT SCALES

The two most common scales used to measure wire are the American Wire Gauge (AWG), used in the United States for non-ferrous (does not contain iron) metals, including precious metals such as sterling silver, and the Imperial (British) Standard Wire Gauge (SWG), used for metal of all types in the United Kingdom and Europe, and for many ferrous metals in the United States. The chart (right) shows the difference between the two measurement scales.

Wire-Scale Comparison Chart

AMERICAN WIRE GAUGE (AWG)		STANDARD WIRE GAUGE (SWG)	
gauge	**diameter**	**gauge**	**diameter**
12g	2.05 mm	12g	2.64 mm
14g	1.63 mm	14g	2.03 mm
16g	1.29 mm	16g	1.63 mm
18g	1.02 mm	18g	1.22 mm
20g	0.81 mm	20g	0.91 mm
22g	0.64 mm	22g	0.71 mm

Diameter measurements rounded.

Purchasing Jump Rings

Weaving chain maille is not difficult—when you have the right materials. Follow these simple steps to make sure you are buying just the right jump rings for your project.

First, choose the weave you'd like to make and the jump-ring type. Use the appropriate Jump-Ring Sizing Chart to determine the gauge and inner diameter and then calculate the number of jump rings you'll need to make the weave at your desired length. Those who are ready to go beyond the recommendations in the chart will calculate the aspect ratio following the instructions in Chain Maille Design 101, page 139. Then, you will need to determine your own jump-rings-per-inch count. I determined the jump-ring counts in the charts by physically counting the jump rings in each weave sample that I made. You may be able to find a recommendation for the jump-ring count you are interested in via an Internet search. If you are creating something unique or unusual, you will have to guesstimate. If you go with larger jump rings, you'll need fewer jump rings per 1″ (2.5 cm), and if you go smaller, you'll need more jump rings per 1″ (2.5 cm).

Now choose a vendor, whether a local bead or craft store or online retailer. You can find suggestions in Resources on page 144. I like to use Urban Maille for silver and The Ring Lord for aluminum (no affiliation, just a satisfied customer). Both of these vendors specialize in jump rings for chain maille, so they understand the specific needs of chain maillers. Type "chain maille suppliers" into your favorite search engine and you'll get many sources to choose from.

Vendors describe jump rings differently, so purchasing jump rings can be confusing for first timers. Here is what you need to remember:

Know Your Inner Diameter

Some vendors list jump rings by inner diameter, some by outer diameter, and some provide both measurements. Inner diameter is the key measurement for chain maille.

If your preferred vendor lists its jump rings by outer diameter, you can determine the correct size jump rings in two ways: refer to the Aspect Ratio Charts, page 145, to find the corresponding outer diameter measurement, or calculate the outer diameter using the formula, OD = ID + (2 × WD).

To calculate outer diameter using our 16-gauge (1.29 mm WD), 4.5 mm ID Byzantine Weave example, you would apply the numbers as follows:
OD = 4.5 + (2 × 1.29); OD = 7.08 mm.

note: To calculate the inner diameter, use the equation, ID = OD – (2 × WD).

Know Your Measurement Scale

You can be reasonably sure that the AWG scale is used to determine wire gauge when purchasing jump rings of precious metal from U.S. jewelry suppliers. The Standard Wire Gauge scale is usually used for nonprecious-metal jump rings and by overseas vendors. If that information is not clearly listed on the vendor's website or in the vendor's catalog, the only way to be absolutely sure is to ask for the diameter of the wire they are using to produce their jump rings. In addition, you may need to convert measurements from inches to millimeters, or vice versa. There is a handy conversion chart in the back of the book.

When you are ready, I recommend that you purchase as many jump rings as you need to finish a project from one source. Making substitutions can be tricky as subtle variations in jump rings from a different manufacturer could create a noticeable line of demarcation in your finished piece of chain maille. And if you've had success creating a piece of chain maille using jump rings purchased from one manufacturer, you may not achieve the exact same result using jump rings from another. Always buy a few more jump rings than you'll need, in case of marring or loss.

If you like the look of gold but can't afford the cost, gold-filled jump rings are a good choice, or you can just use a few strategically placed gold jump rings to accent your chain maille.

Making Jump Rings

There's plenty to think about when choosing the right jump rings for a project, and I am often asked whether I make my own jump rings. I have made many jump rings. The basics involved are simple enough: Coil wire around a mandrel, slip the coil from the mandrel, and use a saw to cut the wire along the coil, forming individual jump rings with flush edges. There is, however, an art to making jump rings of consistent size and quality. I'd rather spend my time weaving chain maille, because that's the fun part, so I purchase my jump rings from local and online suppliers.

Each manufacturer has its own methods, equipment, and metal suppliers, so jump-ring size varies slightly among manufacturers. But how could it possibly matter? I get this question all the time from my students. After all, how different could two jump rings possibly be? There are myriad variables in jump-ring manufacturing.

Metal Type and Temper

When the coiled wire is released, it loosens slightly, an action known as springback. All metals have their own unique characteristics. Stiffer metals have more spring, producing jump rings with an inner diameter slightly larger than the size of the mandrel.

Mandrels

Mandrels are rods, most typically made of steel, around which the wire is coiled. The inner diameter jump-ring size listed by vendors represents the size of the mandrel, not the actual inner diameter of the jump ring.

Some handcrafters use wooden dowels, pens or pencils, or even knitting needles as mandrels. But mandrels made out of softer materials such as wood tend to compress as the wire is coiled around them and thus produce slightly smaller jump rings.

Cutting Method

Jump rings cut with shears and wire cutters pinch the metal, leaving distorted ends. Saw-cut jump rings produce flush ends, preferred for making chain maille jewelry. Kerf is the term used to describe the width of the cut made by the saw. A thick saw blade removes more metal than a thin blade, affecting the size of the finished jump ring.

STORING JUMP RINGS

I store my jump rings in small covered plastic containers, separated and labeled by gauge, inner diameter, metal, and manufacturer so that I know at a glance what to use. This system also enables me to see when I need to purchase more jump rings, the exact sizes I need, and from which manufacturer I should buy. In addition to keeping things organized, the small closed containers limit the jump rings' exposure to air, slowing the tarnishing process.

Other Materials

As you work with chain maille, a wealth of new design opportunities will present themselves—combining weaves, mixing types of metals, and even adding other materials to a weave. Decorative beads in a variety of materials, such as glass, crystal, stone, pearl, and resin, add sparkle and color to chain maille jewelry, as do wire, ribbon, and found embellishments. With chain maille jewelry, the only limit is your creativity. Get started with beads making the Romanov Unit and Captive Inverted Round Maille weaves (pages 44 and 90), and learn more about designing your own jewelry in Finishing (page 131).

To turn all of those jump-ring designs into finished jewelry, you'll need ear wires, bails, and clasps: standard jewelry supplies known as findings. Information about choosing findings and attaching them to chain maille weaves can be found on page 132.

SAFETY FIRST

Smooth-jawed pliers can easily slip off the surface of a round wire jump ring. For this reason, beginners tend to hold their pliers so tightly that the pliers leave dents on the jump rings. To fix this problem, some people coat the jaws of their pliers with tool dip or cover them with tape, moleskin, or even bits of drinking straws to avoid marking their jump rings. I find that these workarounds add an undesirable thickness to the jaws of the pliers and give them a clumsy feel. Therefore, nothing comes between my pliers and my jump rings. With practice, you'll develop just the right touch. Try to stay relaxed as you work, to minimize the risk of jabbing sharp pliers into your fingers and hands.

When opening and closing hundreds of jump rings, it's easy to develop white-knuckle syndrome—aching hands, stiff neck and shoulder muscles, tired eyes, and a headache. Take breaks while working and be aware of basic safety precautions—accidents can happen. Keep tools and jump rings (a choking hazard) away from small children and pets and keep your fingers away from the jaws of the pliers. As when working with any tools, use common sense, handle tools carefully, and wear proper attire such as enclosed shoes and safety glasses—an especially good idea if your sight requires you to hold your tools close to your face. When you are cutting wire, cover the end of the wire with your hand to prevent small bits from becoming flying projectiles.

Tools

To weave chain maille, you need only a few tools. Good tools improve your performance and, therefore, the quality of your work—so buy the best tools you can afford. If you plan on making a lot of chain maille, you'll be glad you did. With proper care, high-quality tools will last a lifetime.

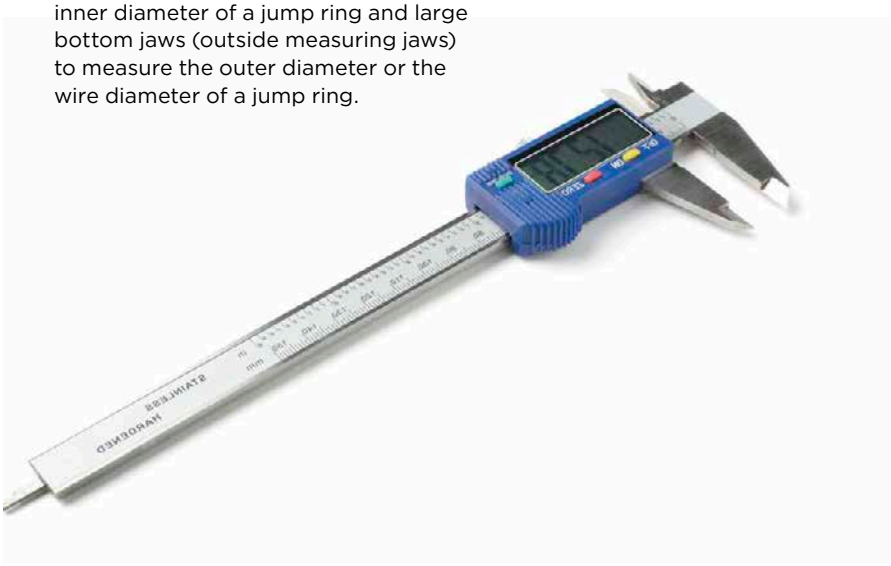
PLIERS

For chain maille, you'll need at least two pairs of pliers, one for each hand. The jaws of the pliers must be smooth, not serrated, as serrated jaws will make undesirable marks on the jump rings. I tell my students that they can use two chain-nose pliers, two flat-nose pliers, or one of each, whatever they prefer. Some people even use the "elbow" section of bent chain-nose pliers as a substitute for a pair of flat-nose pliers.

I like to use two flat-nose pliers because I feel that the flat-nose, rather than the pointed chain-nose, provides more contact with the jump ring, giving me greater control. I even use flat-nose pliers when working with very small jump rings! I find long-handled pliers are more comfortable and provide greater leverage than short-handled pliers, causing less hand strain and fatigue. I use a pair of Lindstrom Rx flat-nose pliers in my left hand and a pair of Swanstrom flat-nose pliers in my right. I like the lightness and feel of the ergonomic Lindstrom handle but prefer the double-leaf spring mechanism of the Swanstrom pliers for manipulating jump rings in my dominant hand. There are many other brands from which to choose. If you are new to chain maille, try out as many types and brands of pliers as you can before buying your tools.

DIGITAL CALIPERS

I find my digital calipers indispensable for determining the exact gauge and inner diameter of jump rings—important for calculating aspect ratio. I use my digital calipers to compare same-size jump rings from different manufacturers and to help me sort jump rings when I've simultaneously dropped various sizes of jump rings on the floor! Digital calipers come in a range of lengths, and for chain maille, a 3" to 4" (7.5 to 10 cm) range is more than sufficient. Use the small top jaws (inside measuring jaws) to measure the inner diameter of a jump ring and large bottom jaws (outside measuring jaws) to measure the outer diameter or the wire diameter of a jump ring.



JUMP-RING OPENING TOOL

This handy little tool makes opening jump rings quicker and easier, which is important when you have to open several hundred jump rings! Just slip it over your finger, insert a jump ring into the slot and twist.

MAGNIFICATION

Make sure you can see. Depending on the size of the jump rings I'm working with, I use drugstore readers, clip-on magnification lenses, an optivisor, a magnifying lamp, or a combination of these devices. I often work and teach with at least two pairs of glasses on my nose!

LOW-TECH TOOLS

I prefer to keep things simple when possible, and the following household items are just as useful for chain maille as any fancy tool.

Toothpicks These are handy for positioning jump rings when weaving into a tight spot.

Dressmaker pins or head pins Pins can help position tiny jump rings when weaving.

Starting aids (paper clips, safety pins, twist ties, clasps, and other jump rings) Sometimes it helps to start a weave on a stable object, such as a jewelry clasp or even a paper clip. Any easily attachable item will do. Starting aids act as a handle to make the weave easier to hold and they serve as markers, so you can identify the starting point of the weave.

Masking tape Jump rings at the beginning of some weaves can be unstable and can slide around in the pattern. To solve this problem, just tape the jump rings in position until the weave stabilizes itself.

EXTRA TOOLS FOR EMBELLISHING

I often add bead dangles, stones, crystals, and pearls to add sparkle and color to my chain maille jewelry. Include the following tools in your chain maille toolkit for creating dangles, unique findings, and other wire embellishments.

Round-nose pliers For making simple loops and wrapped loops, page 137.

Chain-nose pliers For wrapping and tucking wire when making a wrapped loop.

Wire cutters For trimming excess wire.

Crimping pliers For neatly pressing the cut end of a piece of wire.

Small jewelry file or sanding stick For smoothing the cut ends of wire, especially when making ear wires.

Getting Started

Now that you are familiar with the tools and supplies you'll need to make chain maille, it's time to get your hands busy. I'm sure that once you complete your first project, you'll be hooked! Chain maille is my joy. It's what I do when I want to de-stress. For me, constructing the repeating patterns is like meditating. The best part is that when I'm done, not only do I feel relaxed and refreshed, I have a beautiful object to wear or to give to someone special.

We'll start by learning how to use the tools safely and properly. Chain maille involves the use of metal and tools; therefore, it is important to practice safe habits and use common sense so that you can enjoy this rewarding craft for years to come. Next, we'll move on to the basic techniques: opening and closing jump rings and making jump-ring connections. If you're already adept at using pliers and jump rings, check out my tips for Troubleshooting Common Problems on page 23.

Once we've covered all of the basics, the fun begins. It's time to get out your pliers and jump rings and construct some simple starting chains. The Beaded 1 by 2 Chain Bracelet (page 28) is the perfect project for your first real piece of chain maille jewelry.

Working with Jump Rings

When you purchase jump rings, you'll notice that the cut ends are slightly offset, neither fully opened nor fully closed. Generally, jump rings must be opened before beginning a chain maille weave, and the rings are closed once they are in position in the weave. The instructions for each weave in this book include the approximate number of jump rings to prepare.

Some weaves include instructions for speed weaving, a preparation and assembly technique where you pre-close some jump rings and open others. The pre-closed jump rings are threaded onto open jump rings, which are then woven into position and closed. Speed weaving saves you time, as you do not need to individually open and place each jump ring.

OPENING JUMP RINGS

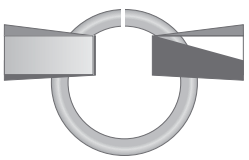
The first step in chain maille is learning to properly open a jump ring.

You can open a jump ring with two pairs of pliers or one pair of pliers and a jump-ring opening tool. *Never* open a jump ring by pulling the ends out to the sides (east and west)! This permanently distorts the shape of the jump ring. Instead, twist the jump ring open by pulling the end in your dominant hand toward your body, while pushing the other end away from your body. Your hands should be moving forward and back in parallel lines.

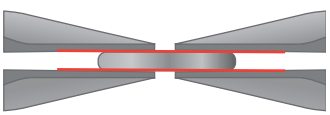
My beginning students always ask how to tell when a jump ring is too open or not open enough. You have to open the jump ring wide enough so that it is easy to weave it into position but not so wide that it begins to catch on other jump rings in your weave. In addition, if you open it too much, it will be more difficult to close neatly. I've noticed that, depending on the weave, it is sometimes beneficial to open a jump ring a little less or a little more. For example, I find that when working on Persian weaves, it helps if the jump ring is not open too wide, but for Spiral weaves, it helps if the jump ring is open a little wider than usual. Don't stress out! You'll quickly develop a feel for these things as you gain experience.

Using Pliers

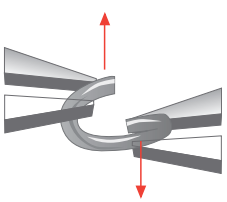
1. Hold the cut end of the jump ring at 12 o'clock using a pair of pliers in each hand. Position the left pair of pliers at 10 o'clock and the right pair of pliers at 2 o'clock—just as you may have been taught (before the advent of air bags) to position your hands on the steering wheel when driving.



2. Adjust the jaws of the pliers as necessary to be parallel to the jump ring.

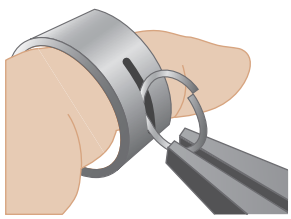


3. Push your nondominant hand slightly forward (away from you) while pulling the dominant hand slightly back (toward you). As a righty, I pull my right hand toward my body as my left hand pushes away from my body.



Using the Jump-Ring Opening Tool

1. Place the jump-ring opening tool on the index finger of your nondominant hand. It should sit right above the middle knuckle with the slot that best accommodates your jump-ring size facing your opposite hand.
2. Pick up a jump ring using pliers held in your dominant hand. The cut ends of the jump ring should be positioned at 12 o'clock and the jaws of the pliers at about 3 o'clock (or 9 o'clock if you're left-handed).
3. Insert the jump ring into the appropriate slot on the tool and open it using one of the following methods.



Method A Twist your finger (with the tool) slightly forward.

Method B Slightly pull your pliers toward you.

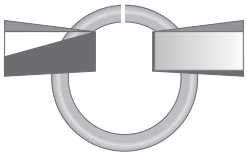
Method C Use a combination of A and B.

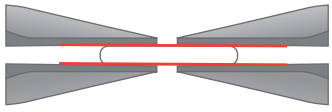
The jump-ring opening tool is used only to open jump rings. To properly close jump rings, you must use two pairs of pliers. Follow the instructions on the next page to close the ring.

CLOSING JUMP RINGS

Closing a jump ring requires much the same technique as opening it: You'll hold the jump ring with pliers and apply the same basic push/pull motion to the jump ring. However, you'll continue the motion to open the jump ring in the opposite direction before settling the ends into place. As you close the jump ring, you'll apply inward pressure on the ends to encourage a tight closure, so you need to use pliers in both hands. The jump-ring opening tool is, as the name implies, for opening jump rings only.

4. Hold the open end of the jump ring at 12 o'clock using a pair of pliers in each hand. Position the left pair of pliers at 10 o'clock and the right pair of pliers at 2 o'clock, as when opening a jump ring. Keep the jaws of the pliers parallel to the jump ring.



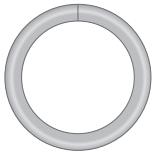


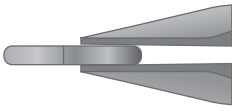
5. Push one hand forward (away from you) while pulling the other hand back (toward you) to bring the ends closer together. While moving the ends together, apply inward pressure on the pliers to force the cut ends to overlap *slightly.*

6. Release the inward pressure and continue moving your hands until you have opened the jump ring in the opposite direction.

7. Now reverse directions and move the ends back toward each other, again applying inward pressure on the pliers to force the ends to overlap slightly.

8. Release the inward pressure and wiggle to align the ends and produce a neat closure. Inspect the closure from both the front and top of the jump ring to ensure full alignment.





Applying Inward Pressure

Wire has memory. For example, if you bend a piece of wire, it stays bent. When you try to pull it straight again, you can still see the spot where you made the bend. The wire retained the memory of that initial force. So when you apply inward pressure to a jump ring, forcing the ends to overlap, and then you pull the ends back enough to align and close, it retains the memory of that inward force and closes tightly without a gap. Moving the ends apart and back together in both directions helps to distribute the tension evenly. Getting the tension just right requires some practice. Not enough pressure, and you will have a gap at the closure; too much, and you'll end up with a crushed jump ring. When you get the tension right, you'll hear the ends of the jump ring click into place as they come together. You should also feel them rub against each other as you align them for a perfect fit. The forward and backward manipulation used to open and close the jump rings also helps to work-harden them.

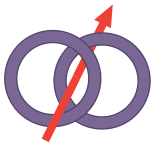
WORK-HARDENING

As you work with wire, it becomes stiffer or work-hardened. Work-hardening can add strength to your chain; however, wire that is overworked can become brittle and break. When the subject of work-hardening comes up, I'm always asked, "How much is too much?" A jump ring is not a Thanksgiving turkey. It does not have a pop-up thermometer to tell you when it's done. Jump rings vary slightly from source to source, so there is no hard-and-fast rule. You need to develop the feel. The best way to do this is to sacrifice a jump ring or two to the chain maille gods. Take a jump ring and open and close it over and over. Notice how each time you do it the resistance builds. Keep going to the point of failure so you'll learn to recognize how it feels.

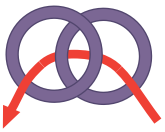
CONNECTING JUMP RINGS

1. Most times, connecting jump rings is a straightforward process; just thread one open jump ring directly through the center of a closed jump ring or two (or more) parallel jump rings.

2. The most common types of adjacent jump-ring connections are through-the-eye (TE) connections and around-the-eye connections (AE).



Through the Eye Connection (TE)



Around the Eye Connection (AE)

Jump rings are round (obviously), so you need to use a round scooping motion, instead of a straight stabbing motion, when weaving them together. Avoid accidentally catching nearby jump rings by following the path of an open jump ring before closing it, ensuring that it enters and exits at the proper locations. Jump rings are prone to twisting around, and it's easy to thread a jump ring through the wrong spot.

You may have read or heard someone say, "Never put your pliers down when weaving. Your pliers should become extensions of your hands. Repeatedly putting pliers down and picking them up is counterproductive and wastes time . . ." It's great if you're comfortable working that way. I'm not. I like to work hands-on, picking up the jump rings and weaving with my fingers. That's how I'm comfortable, and I'm more productive when I'm comfortable. In addition, I feel the jump rings are less subject to being scratched when exposure to the pliers is limited. In chain maille, as in life, there is no one right way, and I encourage you to find your own comfort zone and to work happily within it.

A FEW MORE THOUGHTS

Here are some additional tips and suggestions that can help to make your chain maille experience more fun and productive.

Get comfortable Make sure you're in a cozy spot when you work, with all your supplies in reach, adequate lighting, and a supportive chair. Keep some water close by and play your favorite music or listen to an audio book or podcast.

Take notes I always keep a pen or pencil and a notebook nearby. When you are creating, write down the number, size, metal type, and manufacturer of the supplies you are using to construct your jewelry.

Try again Sometimes you'll come across a difficult jump ring that will just refuse to be placed in the weave. If this happens to you, don't stress and struggle. Put the jump ring back in the pile and choose another. Try again with the new jump ring and often you'll discover that it slides easily into place.

Use gravity Many times the jump rings in a chain maille weave will shift position, especially if the weave is a bit loose. This shifting causes the most confusion among my students. One way to keep the rings in proper position is to use gravity. I know some women my age won't agree with this statement, but in chain maille at least, gravity is your friend. Just hold the piece upside down, and gravity will help the jump rings settle into position.

Trust yourself There is always more than one way to accomplish something. In the chapters that follow, I've provided multiple options for completing many traditional weaves. I encourage you to try them all and choose the methods you find most comfortable. Along the way, you'll probably come up with additional methods of your own!

Relax Chain maille is supposed to be fun!

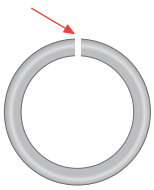
Troubleshooting Common Problems

It's easiest to correct errors in a chain maille weave if you catch them as you go. If you weave a substantial amount, only to notice that you made a placement error early on, you'll be upset when you have unweave all the correctly placed jump rings to fix the error, so inspect your weave along the way.

Improper closures are the number-one problem in chain maille weaving. A distorted or slightly opened jump ring may make weaving the pattern difficult. A piece of jewelry with sloppy closures could irritate the skin and catch in clothing and hair. The most important thing you can do is inspect each jump ring from all angles before you move on, making sure that it is neatly and fully closed. If the closure is difficult to see, feel for a gap or overhanging edge along the jump ring. The three most common problems are gaps in jump-ring closures, overhanging jump-ring edges, and warped jump rings.

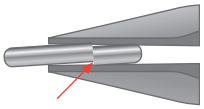
Gaps In Jump-Ring Closures

Hold the jump ring up to a light. If you can see that light coming through the seam, the jump ring is not fully closed. To fix, repeat the steps for closing a jump ring, page 21, making sure you are applying adequate inward pressure.

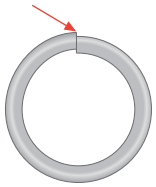


Overhanging Jump-Ring Edges

The edges of a jump ring may overhang from side to side (horizontally) or from top to bottom (vertically). If horizontal, fix the overhang by repeating the steps for closing a jump ring, ensuring that you carefully align the edges.



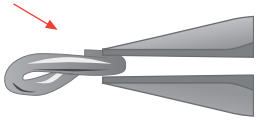
Fixing a vertical overhang is more difficult because it is usually caused by unequal pressure applied to the left and right sides of the jump ring when it was closed. Repeat the steps for closing a jump ring, but when you apply inward pressure, try to compensate by adding more pressure on the high side. If you mangle the jump ring while trying to correct the overhang, remove it and insert a fresh one. Never try to remedy this situation by squeezing the high side down; you will likely distort the shape of the jump ring, necessitating a replacement.



Warped Jump Rings

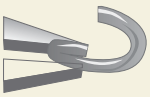
This common problem is known to maillers as a "taco-ed" jump ring because the saddle-shaped warp resembles a taco shell. The distortion is usually caused by improperly positioned pliers when the jump ring was closed. Discard it and start with a fresh jump ring, making sure that the pliers are properly positioned and that the jaws of the pliers are parallel to the jump ring.

If you end up distorting or marring a jump ring when trying to correct these problems, discard it and start with a fresh jump ring. Chain maille jewelry drapes and moves with fluidity because the round surfaces of the jump rings facilitate smooth movements. Distorted and marred jump rings will not only detract from the look of a finished piece of jewelry but will also disrupt the piece's ability to flex and flow.

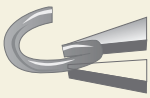


GIVE 'EM A HAND

Before I began teaching, I never paid attention to the direction I opened jump rings. I just naturally pulled my dominant right hand toward my body, producing right-handed jump rings. Then, I had a student who was struggling to weave, and together we figured out why. She was left-handed but opened her jump rings in the right-handed direction, which made it difficult to weave the jump rings using her dominant left hand. When we switched the hand that pulled back and the hand that pushed forward, the problem vanished. You switch-hitters have to figure out for yourselves which way is more comfortable for you. If you are having trouble weaving, try opening jump rings in the opposite direction and see if that makes weaving easier for you.



left-handed



right-handed

Weave Starters

Every piece of chain maille begins with a simple connection. You will begin most chain maille weaves by using one of these basic weave starters. Many patterns start something like this: "Make a 2-1-2-1-2 chain." This simply means to make a 2 jump ring by 1 jump ring chain that is 5 links long. Chain starters can also stand on their own as simple bracelets and neck chains that can be embellished with beads, crystals, and charms, as shown in the sample project on page 28. Use the instructions that follow to make a 1 by 1 chain, 1 by 2 chain, 2 by 1 chain, and 2 by 2 chain.

1 by 1 chain

This is simply a chain consisting of one single jump ring linked to the next.

1. Open 1 jump ring and close 2 jump rings (**FIG. 1**).
2. Thread the open jump ring through the 2 closed jump rings, and then close the open jump ring (**FIG. 2**).
3. Arrange the 1 by 1 by 1 chain as shown in **FIG. 3** and set aside.
4. Open 1 jump ring and close 1 jump ring (**FIG. 4**).
5. Thread the open jump ring through the closed jump ring but do not close it (**FIG. 5**).
6. Now thread the open jump ring *with the closed jump ring on it* through the closed jump ring at the end of the chain set aside in Step 3. Close the open jump ring (**FIG. 6**).

You have just completed a 1-1-1-1-1 chain (a 1 by 1 chain that is 5 links long).

USED IN: Caged Pearls Round Maille Bracelet (page 98), Reversible Double Half-Persian 4-in-1 Collar (page 116), Royal Dragonscale Collar (page 126)

FIG. 1

FIG. 2

FIG. 3

FIG. 4

FIG. 5

FIG. 6

1 by 2 chain

This chain consists of single jump rings connected to pairs of jump rings. For the 1 by 2 arrangement, start with a single jump ring.

1. Open 2 jump rings and close 2 jump rings (**FIG. 1**).
2. Thread 1 open jump ring through the 2 closed jump rings, and then close the open jump ring (**FIG. 2**).
3. Thread the remaining open jump ring through the same two closed jump rings as you did in the previous step but do not close it. Arrange the 1 by 2 by 1 chain as shown in **FIG. 3** and set aside.
4. Open 1 jump ring and close 2 jump rings (**FIG. 4**).
5. Thread the open jump ring through the 2 closed jump rings, and then close the open jump ring (**FIG. 5**).
6. Pick up the piece set aside in Step 3 and thread that open jump ring through the 2 jump rings closed in Step 4. Close the open jump ring (**FIG. 6**).

You have just completed a 1-2-1-2-1 chain (a 1 by 2 chain that is 5 links long).

USED IN: Beaded 1 by 2 Chain Bracelet (page 28)

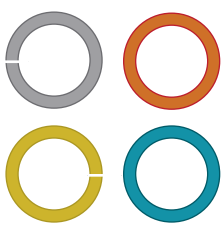


FIG. 1

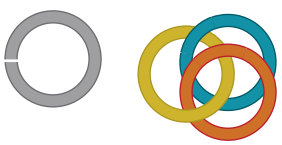


FIG. 2

FIG. 3

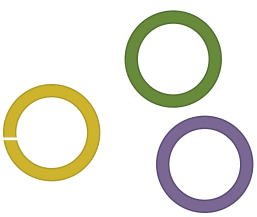


FIG. 4

FIG. 5

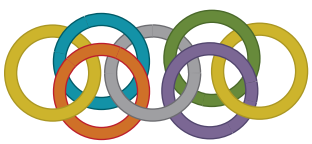


FIG. 6

2 by 1 chain

As in the 1 by 2 chain, this chain also consists of single jump rings connected to pairs of jump rings. However, the 2 by 1 arrangement begins with a pair of jump rings.

1. Open 1 jump ring and close 4 jump rings (**FIG. 1**).
2. Thread the open jump ring through the 4 closed jump rings (**FIG. 2**), and then close the open jump ring.
3. Arrange the 2 by 1 by 2 chain as shown in **FIG. 3** and set aside.
4. Open 1 jump ring and close 2 jump rings (**FIG. 4**).
5. Thread the open jump ring through the 2 closed jump rings but do not close it (**FIG. 5**).
6. Now thread the open jump ring *with the 2 closed jump rings on it* through the 2 closed jump rings at the end of the chain set aside in Step 3. Close the open jump ring (**FIG. 6**).

You have just completed a 2-1-2-1-2 chain (a 2 by 1 chain that is 5 links long).

USED IN: European 4-in-1 (Closing a Tube from Side to Side, page 67), Round Maille Weaves (page 89)

FIG. 1

FIG. 2

FIG. 3

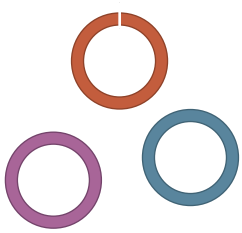


FIG. 4

FIG. 5

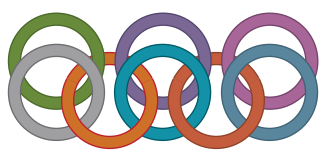


FIG. 6

2 by 2 chain

The 2 by 2 chain consists of connected pairs of jump rings.

1. Open 2 jump rings and close 4 jump rings (**FIG. 1**).
2. Thread 1 open jump ring through the 4 closed jump rings, and then close the open jump ring (**FIG. 2**).
3. Thread the remaining open jump ring through the same 4 closed jump rings, and then close the open jump ring (**FIG 3**).
4. Arrange the 2 by 2 by 2 chain as shown in **FIG. 4** and set aside.
5. Open 2 jump rings and close 2 jump rings (**FIG. 5**).
6. Thread 1 open jump ring through the 2 closed jump rings but do not close it (**FIG. 6**).
7. Now thread the open jump ring *with the 2 closed jump rings on it* through the 2 closed jump rings at the end of the chain set aside in Step 4. Close the open jump ring (**FIG. 7**).
8. Thread the remaining open jump ring through the 2 sets of closed jump rings joined in Step 7. Close the open jump ring (**FIG. 8**).

   You have just completed a 2-2-2-2-2 chain (a 2 by 2 chain that is 5 links long).

USED IN: Byzantine Weave (page 32), Box Chain (page 38), Full Persian Weave (page 102)

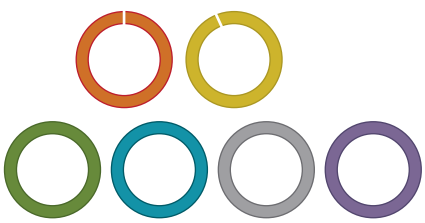


FIG. 1

FIG. 2

FIG. 3

FIG. 4

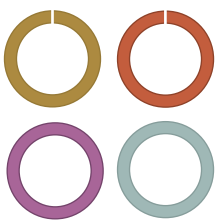


FIG. 5

FIG. 6

FIG. 7

FIG. 8

Beaded 1 by 2 Chain Bracelet

A simple 1 by 2 weave starter becomes a bracelet project entirely its own—just perfect for those getting started with chain maille. Add beads and use jump rings of varying sizes to transform this utilitarian add-on into a stylish accessory.

SUPPLIES

30 sterling silver jump rings, 16g (AWG), 4.5 mm ID

16 sterling silver jump rings, 16g (AWG), 6.0 mm ID

28 sterling silver round beads, 4 mm, with 1.5 mm bead holes

1 sterling silver lobster clasp, 18 mm

FINISHED LENGTH

6″ (15 cm) not including clasp. For a longer bracelet, connect additional beaded links using 2 jump rings, 4.5 mm ID.

Prepare

1. Open all but 2 of the 6.0 mm ID jump rings. Create individual beaded links by threading 2 beads onto each opened jump ring. Close each beaded link.
2. Close 1 of the remaining 6.0 mm ID jump rings and open the other. Set aside.
3. Open all of the 4.5 mm ID jump rings.

Connect

4. Connect each beaded link using 2 of the 4.5 mm jump rings. When connecting the beaded links, be sure to position the beads to the right and left of the connecting links.
5. When all of the beaded links are connected, use 2 of the 4.5 mm jump rings to connect the closed 6.0 mm jump ring set aside in Step 2 to one end of the chain. This closed jump ring will be the catch for the clasp.

Finish

6. Thread 2 of the remaining 4.5 mm jump rings through the other end of the chain and close them. Thread the open 6.0 mm jump ring set aside in Step 2 through these 4.5 mm jump rings and the clasp and then close the jump ring.

Byzantine Weaves

The Byzantine weave is an ancient and classic jewelry weave also known by several other names, such as Birdcage and Idiot's Delight (yes, really!). It is a 4-in-1 weave, which means that each single link in the chain has four other links passing through it. The pattern looks complex, yet it is easy to construct, making it the perfect weave to start with. Jump rings are linked in pairs, and intricate detail is achieved through a simple folding technique. Beginners, this one's for you!

The Byzantine weave is extremely versatile. The chain is quite beautiful on its own and can be easily broken down into smaller symmetrical segments and connected in a variety of ways, making it possible to design all types of jewelry: earrings, necklaces, and bracelets, such as the Byzantine Evil-Eye Bracelet on page 46. The open spaces in the weave are perfect spots for attaching beads and charms, providing endless embellishment opportunities.

In this chapter, you'll learn how to weave the basic Byzantine chain and how to take advantage of speed-weaving techniques to finish projects faster than ever. The Byzantine weave has many variations, and you'll learn how to make a Flower Unit (page 43), the Byzantine Rose Chain (page 41), Triple-Point Byzantine and Romanov units (page 36 and 44), and the Box Chain (page 38).

Byzantine Weave

Byzantine weave is my favorite beginner's weave. It's simple to make, easy to learn, and absolutely amazing to look at—a real confidence booster. The weave is also easy to break down into smaller components that can provide infinite design possibilities. Try spicing things up by using jump rings in different colors, metals, or textures to highlight repeated elements in the pattern, such as the folded jump rings or the filler pair of jump rings.

Jump-Ring Sizing

METAL	16-GAUGE		18-GAUGE	
	inner diameter	**rings per inch**	**inner diameter**	**rings per inch**
Sterling silver (AWG)	4.5 mm	22	3.5 mm	28
Aluminum (SWG)	7/32"	18	5/32"	26

Prepare Jump Rings

1. Close 4 jump rings (to be used in starter chain) and open the rest.

Start the Weave

2. Make a 2-2-2 chain, following the instructions on page 27 (**FIG. 1**).

Weave the Pattern

The magic number for the Byzantine weave is six—that's how many jump rings you'll need to make each repeat of the pattern.

3. Fold Back and Spread (Prepare)

   Hold the starter chain at the middle pair of jump rings (yellow) and let the top 2 (orange) jump rings flop out to the left and right sides (**FIG. 2**).

   Fold back those (orange) jump rings down against the sides of the chain (**FIG. 3**).

   Spread open the 2 (yellow) jump rings that are now on top (**FIG. 4**) to expose the inner (orange) jump rings.

4. Fill the Spread (Add 2)

   Working between the spread jump rings, thread 1 open (white) jump ring through the inner jump rings and then close it.

Again working between the spread jump rings, thread another open (white) jump ring through the inner jump rings, and then close it (**FIG. 5**).

5. Add 2 (Twice)

   Thread and close first one and then a second open (green) jump ring through the top 2 jump rings (**FIG. 6**).

   Thread and close first one and then a second open (purple) jump ring through the top 2 jump rings just added (**FIG. 7**). The first pattern repeat is complete.

6. Fold Back and Spread

   Fold back the top (purple) jump rings, down against the sides of the chain (**FIG. 8**).

   Spread open the 2 (green) jump rings that are now on top (**FIG. 9**) to expose the inner (purple) jump rings.

7. Fill the Spread

   Working between the spread jump rings, thread 1 open (light blue) jump ring through the inner jump rings and then close it.

   Again working between the spread jump rings, thread another open (light blue) jump ring through the inner jump rings and then close it (**FIG. 10**).

8. Continue adding jump rings in groups of 6, as instructed: Add 2 (twice), Fold Back and Spread, Fill the Spread, (**FIGS. 6–10**). When the weave reaches the desired length, end after the Fill the Spread step (2 of 6 jump rings added).

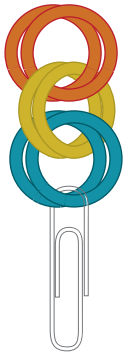


FIG. 1

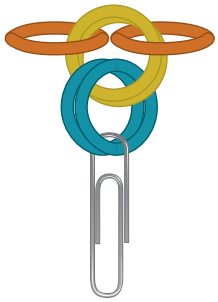


FIG. 2

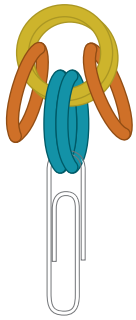


FIG. 3

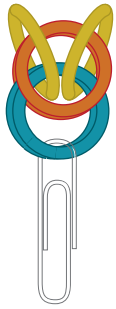


FIG. 4

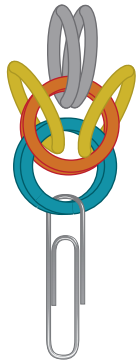


FIG. 5

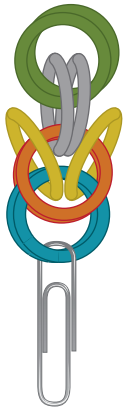


FIG. 6

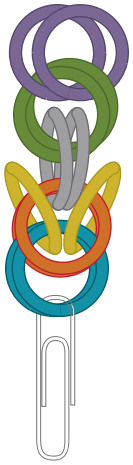


FIG. 7

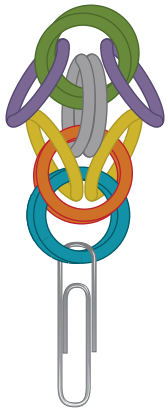


FIG. 8

FIG. 9

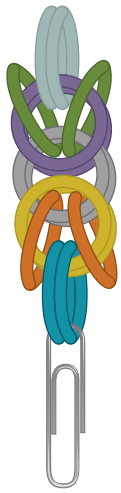


FIG. 10

Speed Weaving Byzantine (2 Ways)

I've presented two ways to speed-weave Byzantine chain. In the first method, jump rings 3 and 4 of the "magic six" are the pre-closed jump rings. In the second method, jump rings 5 and 6 of the magic six are the pre-closed jump rings. No matter how you approach it, straight or speed weaving, once all 6 jump rings have been added, you will arrive at the Fold Back and Spread step, and the process repeats.

Prepare Jump Rings

1. Close about one-third and open about two-thirds of your jump rings.

Start the Weave

2. Make a 2-2-2 chain, following the instructions on page 27 (**FIG. 1**).

Weave the Pattern

To speed-weave Byzantine chain maille, begin in the same way as for the traditional weaving technique, folding back and spreading the jump rings at the top of the starter chain. Then add 6 jump rings following either Method A or Method B, as instructed. Remember, the magic number for Byzantine is six.

3. Fold Back and Spread (Prepare)

   Hold the starter chain at the middle pair of jump rings (yellow) and let the top 2 (orange) jump rings flop out to the left and right sides (**FIG. 2**).

   Fold back those (orange) jump rings down against the sides of the chain (**FIG. 3**).

   Spread open the 2 (yellow) jump rings that are now on top (**FIG. 4**) to expose the inner (orange) jump rings.

   Follow Steps 4 and 5 of either Method A or B.

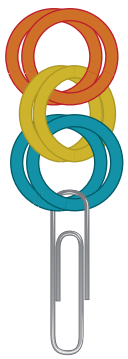


FIG. 1

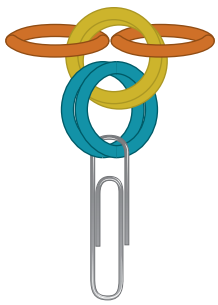


FIG. 2

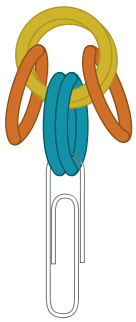


FIG. 3

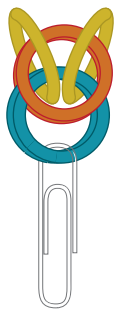


FIG. 4

Method A

4. Fill the Spread (Add 4)

   Start with 2 open (white) jump rings and 2 closed (green) jump rings.

   Thread 1 open (white) jump ring through 2 closed (green) jump rings. Do not close the open jump ring (**FIG. 5**).

   Working between the spread (yellow) jump rings, thread the open (white) jump ring with the 2 closed jump rings on it straight through the inner (orange) jump rings and close it (**FIG. 6**).

   Again working between the spread jump rings, thread the other open (white) jump ring through the inner (orange) jump rings and the 2 closed jump rings and then close it (**FIG. 7**).

5. Add 2

   Thread and close first one and then a second open (purple) jump ring through the 2 top closed jump rings (**FIG. 8**).

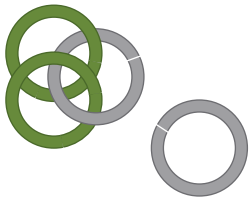


FIG. 5
(METHOD A)

FIG. 6
(METHOD A)

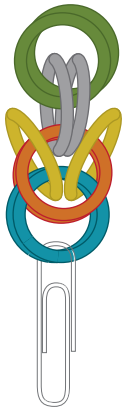


FIG. 7
(METHOD A)

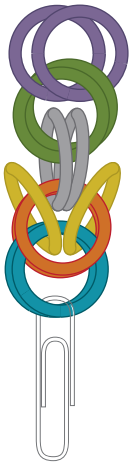


FIG. 8
(METHODS A AND B)

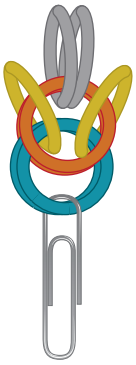


FIG. 9
(METHOD B)

Method B

4. Fill the Spread (Add 2)

   Working between the spread (yellow) jump rings, thread and close first one and then a second open (white) jump ring straight through the inner (orange) jump rings (**FIG. 9**).

5. Add 4

   Start with 2 open (green) jump rings and 2 closed (purple) jump rings.

   Thread 1 open (green) jump ring through 2 closed (purple) jump rings. Do not close the open jump ring (**FIG. 10**).

   Thread the open (green) jump ring with the 2 closed jump rings on it through the top 2 (white) jump rings on the end of the chain and close it (**FIG. 11**).

   Thread the other open (green) jump ring through the 2 sets of jump rings just connected (**FIG. 8**).

Both Methods

6. Fold back and spread the top jump rings as in Step 3 **(FIGS. 12 AND 13**).

7. Continue adding jump rings in groups of 6, following either Method A (Steps 4 and 5) or Method B (Steps 4 and 5). Then fold back and spread the jump rings (Step 6).

8. When the weave reaches the desired length, end by filling the spread as shown in **FIG. 14**.

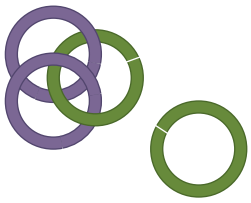


FIG. 10
(METHOD B)

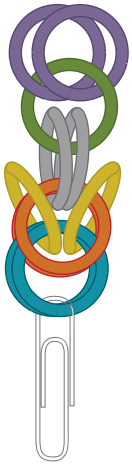


FIG. 11
(METHOD B)

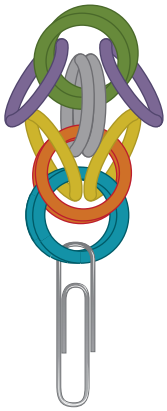


FIG. 12

FIG. 13

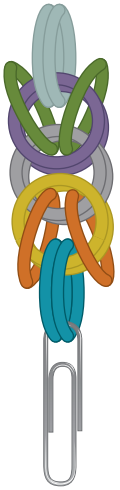


FIG. 14

Triple-Point Byzantine Unit

The Triple-Point Byzantine Unit provides endless design possibilities. To construct it, start with a Byzantine Chain segment comprised of 14 jump rings and then add the additional point. These units can be connected together in a linear fashion to make a chain or grouped to create geometric patterns. You can connect the individual units using a simple jump ring (or two), a special jump ring (such as a twisted wire jump ring), a Flower Unit (page 43), or another decorative link or component. The points can be embellished with beads, crystals, or pearls. This unit also makes a great Y-connector for a necklace.

Jump-Ring Sizing

METAL	16-GAUGE		18-GAUGE	
	inner diameter	**unit size**	**inner diameter**	**unit size**
Sterling silver (AWG)	4.5 mm	¾″	3.5 mm	½″
Aluminum (SWG)	7/32″	1″	5/32″	¾″

Prepare

1. Make a segment of Byzantine chain using 14 jump rings, following the instructions on page 32 (**FIG. 1**).

Make the Triple Point

2. Thread 2 open (orange) jump rings through the 2 (white) jump rings at the center of the Byzantine segment and then close them (**FIG. 2**).
3. Thread and close 2 (purple) jump rings through the 2 (orange) jump rings just added (**FIG. 3**).
4. Fold back the 2 (purple) jump rings just added (**FIG. 4**).
5. Spread open the 2 (orange) jump rings that are now at the end (**FIG. 5**) exposing the inner (purple) jump rings.
6. Working between the spread jump rings, thread and close 2 (yellow) jump rings straight through the inner (purple) jump rings (**FIG. 6**).

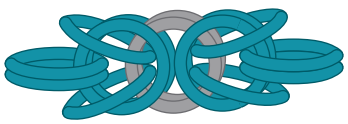


FIG. 1

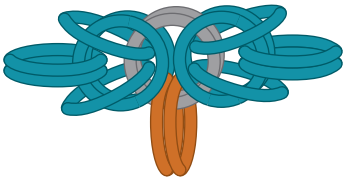


FIG. 2

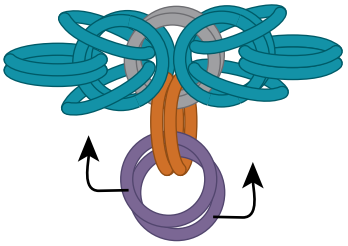


FIG. 3

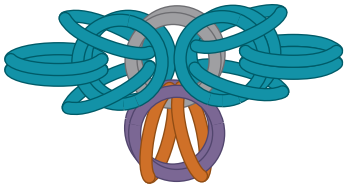


FIG. 4

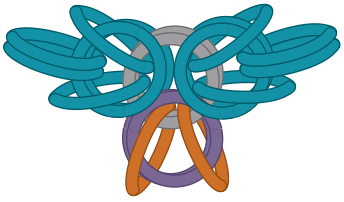


FIG. 5

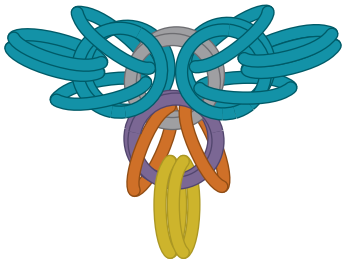


FIG. 6

TRY THIS:

Byzantine Cross Unit

Use slightly larger jump rings in the center of the Byzantine segment to accommodate a fourth point, creating a Byzantine Cross Unit.

Box Chain

Box Chain, also known as Queen's Link, is, basically, the traditional Byzantine weave minus one step. The difference in method is subtle, but the resulting appearance is anything but, and it boasts a slinky, sinuous look. I like my weaves on the tight side, so the suggested jump-ring sizes produce a dense chain with a rectangular profile. You can produce a more open and airy chain that has a square profile, reflective of the name Box Chain, by increasing the inner diameter of your jump rings by about .25 mm to .50 mm.

Jump-Ring Sizing

METAL	16-GAUGE		18-GAUGE	
	inner diameter	**rings per inch**	**inner diameter**	**rings per inch**
Sterling silver (AWG)	5.25 mm	28	4.0 mm	32
Aluminum (SWG)	¼″	24	3⁄16″	32

Prepare Jump Rings

1. Close 4 jump rings (to be used in starter chain) and open the rest.

Start the Weave

2. Make a 2-2-2 chain, following the instructions on page 27.

Weave the Pattern

The Box Chain Weave follows the same basic technique as the Byzantine Weave, page 32, adding 4 jump rings (instead of 6) before the folding step. The magic number for the Box Chain weave is four.

3. Begin the weave by following Steps 3 and 4 of the basic Byzantine Weave, folding back and spreading open the top jump rings and filling the spread. Add 2 jump rings through the jump rings just added (**FIG. 1**). The first pattern repeat is complete.

4. Fold Back and Spread

   Fold back the 2 (green) jump rings at the top of the chain down against the sides of the chain (**FIG. 2**).

   Spread open the 2 (white) jump rings that are now on top (**FIG. 3**) exposing the inner (green) jump rings.

5. Fill the Spread (Add 2)

   Working between the spread jump rings, thread 1 open (purple) jump ring straight through the inner (green) jump rings and then close it.

   Again working between the spread jump rings, thread another open (purple) jump ring through the inner (green) jump rings and then close it (**FIG. 4**).

6. Add 2

   Thread and close first 1 and then a second open (dark blue) jump ring through the top 2 (purple) jump rings (**FIG. 5**).

7. Continue adding jump rings in groups of 4, as instructed: Fold Back and Spread, Fill the Spread, Add 2, Steps 4–6. When the weave reaches the desired length, end after Step 5 (Fill the Spread).

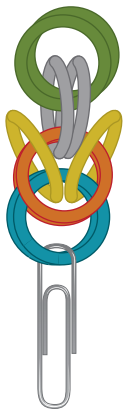


FIG. 1

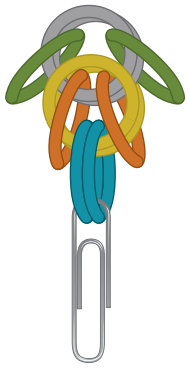


FIG. 2

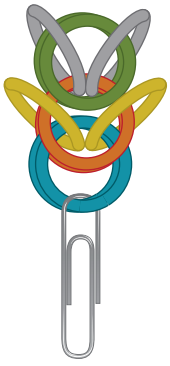


FIG. 3

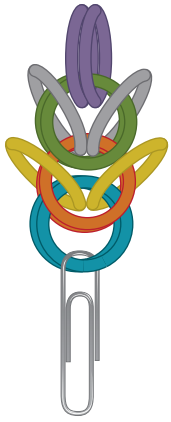


FIG. 4

FIG. 5

Speed Weaving Box Chain

Remember, the magic number for Box Chain is four. Jump rings 3 and 4 of the magic four are the pre-closed jump rings.

Prepare Jump Rings

1. Close half of the jump rings and open the other half.

Start the Weave

2. Make a 2-2-2 chain, following the instructions on page 27.

Weave the Pattern

3. Begin the weave by following Step 3 of Speed Weaving Byzantine chain, folding back and spreading open the top jump rings (**FIG. 1**).

4. Fill with 4 (Add 2 Twice)

   Start with 2 open (white) jump rings and 2 closed (green) jump rings, as in Speed Weaving Byzantine chain, Method A, Step 4.

   Thread 1 open (white) jump ring through 2 closed (green) jump rings. Do not close the open jump ring (**FIG. 2**).

   Working between the spread (yellow) jump rings, thread the open (white) jump ring with the 2 closed jump rings on it straight through the inner (orange) jump rings and close it (**FIG. 3**).

   Again working between the spread jump rings, thread the other open (white) jump ring through the inner (orange) jump rings and the 2 closed jump rings and then close it (**FIG. 4**).

5. Fold Back and Spread

   Fold back the 2 (green) jump rings at the top of the chain down against the sides of the chain (**FIG. 5**).

   Spread open the 2 (white) jump rings that are now on top (**FIG. 6**) exposing the inner (green) jump rings.

6. Repeat Steps 4 and 5 until weave reaches the desired length. End by filling the spread as shown in **FIG. 7**.

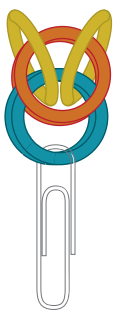


FIG. 1

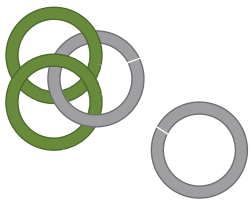


FIG. 2

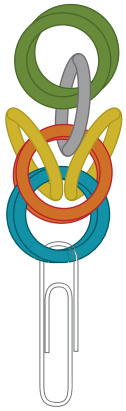


FIG. 3

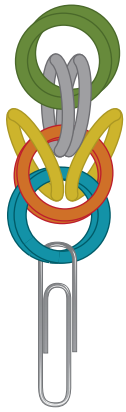


FIG. 4

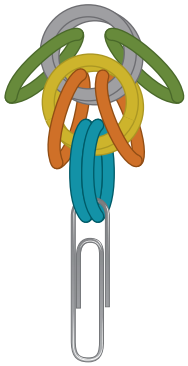


FIG. 5

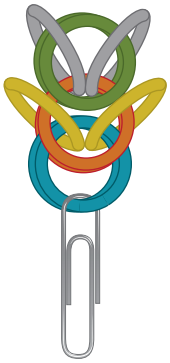


FIG. 6

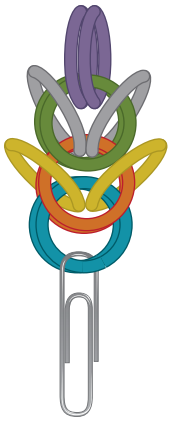


FIG. 7

Byzantine Rose Chain

A popular variation on the straight Byzantine weave is to combine it with what is called a Flower Unit (or a Rosette, as these formations resemble a rosebud) to produce the Byzantine Rose weave. These flower units are incorporated into the weave at evenly spaced intervals to produce this elegant Byzantine variation.

In this section, you'll learn how to make flower units as stand-alone motifs, as well as learning how to integrate them into the Byzantine weave. You can enhance this pattern by using colored or textured wire to create the flowers.

Jump-Ring Sizing

METAL	16-GAUGE		18-GAUGE	
	inner diameter	**rings per inch**	**inner diameter**	**rings per inch**
	chain (flower)	**chain (flower)**	**chain (flower)**	**chain (flower)**
Sterling silver (AWG)	4.5 mm (7.0 mm)	14 (3)	3.5 mm (6.0 mm)	22 (3)
Aluminum (SWG)	7⁄32″ (5⁄16″)	10 (3)	5⁄32″ (1⁄4″)	16 (3)

Prepare Jump Rings

When constructing the Byzantine Rose Chain, you will be working with two sizes of jump rings. The smaller jump rings construct the Byzantine Chain segments, and the larger jump rings construct the Flower Units. Each Byzantine Chain segment consists of 14 small jump rings, and each Flower Unit consists of 3 large jump rings.

1. Open all of the large jump rings. Close 4 of the small jump rings (to be used in starter chain) and open the rest. Keep the different sizes in separate piles.

Weave the Chain

2. Using 14 small jump rings, make a segment of Byzantine chain, following the instructions on page 32.

3. Thread 1 large open jump ring through the 2 jump rings at the end of your segment and then close it (**FIG. 1**).

4. Thread 1 large open jump ring through the 2 jump rings at the end of your segment and then through the center of the large jump ring added in the previous step. Close the jump ring just added to begin the Flower Unit (**FIG. 2**).

   note: See Building a Flower Unit, opposite, for more information on making individual units and Flower Unit chains.

5. Thread another large open jump ring through the 2 jump rings at the end of your segment and then through the center of the Flower Unit. Close the large jump ring (**FIG. 3**).

6. Using 14 small jump rings, build the next Byzantine segment onto the Flower Unit made in Steps 3–5. Begin the Byzantine segment by connecting the first 2 jump rings of the segment through the center of the Flower Unit.

7. Continue weaving, alternating Flower Units and Byzantine segments until your chain reaches the desired length.

FIG. 1

FIG. 2

FIG. 3

Building a Flower Unit

The Flower Unit, also known as a Möbius or Rosette, is a versatile design component that can be mixed with other weaves as a design element or simply connected into a chain. Experiment with different-size jump rings to make units and chains with different looks.

Prepare Jump Rings

1. Prepare enough open and closed jump rings to make the number of units you need. Flower Units are most commonly made using 1 closed jump ring and 2 open jump rings.

Make a Flower

2. Thread 1 open jump ring onto 1 closed jump ring and close it (**FIG. 1**).
3. Holding these 2 (blue/orange) jump rings together, thread another open (yellow) jump ring through them both using a TE connection (page 22) and close it (**FIG. 2**).
4. Arrange these jump rings into the flower shape (**FIG. 3**).

Connecting Flower Units to Make a Chain

Simply connect units to make a chain—even with Flower Units of different sizes! The size of the jump rings you need to connect the units will depend on the size of the jump rings used to construct them. The connecting jump rings need to be large enough to contain 2 of your Flower Units, side by side, providing just enough space to keep them in proper position without restricting movement.

5. Thread 1 or 2 open jump rings through the center of 2 Flower Units, depending on your design preference, and then close the open jump ring(s) (**FIGS. 4 AND 5**).
6. Continue joining Flower Units to make a flower chain (**FIG. 6**).

Make a Flower Unit with only 2 jump rings. This smaller, lighter unit works well for earrings.

Add additional jump rings to make a unit called a Möbius.

FIG. 1

FIG. 2

FIG. 3

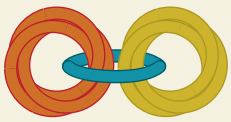


FIG. 4

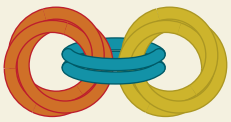


FIG. 5

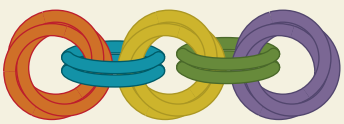


FIG. 6

Romanov Unit

Romanov Units get their name from the style they evoke, reminiscent of the opulent jewels of the Russian Empire. Romanov Units are comprised of two Byzantine segments connected by larger single jump rings. These double Byzantine segments elegantly frame an enclosed bead, pearl, or crystal. Just as in Flower and Triple-Point Byzantine units, Romanov units can be used alone, connected to form chains, or combined with other weaves as decorative accents.

Jump-Ring Sizing

METAL	16-GAUGE		18-GAUGE	
	inner diameter	rings per ¾″ unit	inner diameter	rings per ½″ unit
Sterling silver (AWG)	4.5 mm	28	3.5 mm	28

ADDITIONAL SUPPLIES

1 sterling silver eye pin per unit

1 round bead, 8 mm, per 16-gauge unit

1 round bead, 6 mm, per 18-gauge unit

Larger Connecting Jump Rings:

For 16-gauge units, 2 sterling silver 16g 6.0–7.0 mm jump rings per unit; or 1 per unit if connecting to make a chain, plus 1 to end the chain.

For 18-gauge units, 2 sterling silver 16g 5.5–6.0 mm jump rings per unit; or 1 per unit if connecting to make a chain, plus 1 to end the chain.

Prepare Components

1. Make 2 segments of Byzantine chain using 14 small jump rings each, following the instructions on page 32.
2. Make 1 bead component: Thread the bead onto the eye pin. At the straight end of the eye pin, make a simple loop close to the bead using round-nose pliers (page 137). Cut off the excess wire using wire cutters. Align the loops at each end of the bead so both loops face in the same direction.
3. Open 1 (or 2 if making a stand-alone unit) large jump ring(s) per unit. If connecting units to make a chain, open 1 additional large jump ring to finish the end of your chain (**FIG. 1**).

Make the Unit

4. Thread 1 Byzantine chain segment, 1 bead component, and then another Byzantine segment onto a large open jump ring. Close the jump ring (**FIG. 2**).
5. Thread another large open jump ring through the opposite ends of the Byzantine chains and bead component joined in Step 4. To create a stand-alone unit, close this large jump ring. Do not close the jump ring if connecting units to construct a chain (**FIG. 3**).

Connecting Romanov Units to Form a Chain

6. Thread 1 Byzantine chain segment, 1 bead component, and another Byzantine segment onto the large open jump ring just added (**FIG. 4**). Close the jump ring (**FIG. 5**).

note: Closing the jump ring at this step can be a little tricky because, with all of the components now on the jump ring, there is not a lot of surface left to grab with your pliers; the larger the jump ring, the easier it will be.

7. Continue joining chain and bead components to make a Romanov chain (**FIG. 6**).

8. To finish the chain, thread 1 large open jump ring through the ends of the last Byzantine segments and bead component. Close the jump ring (**FIG. 7**).

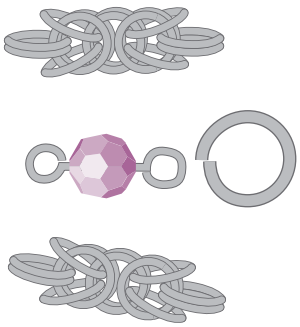


FIG. 1

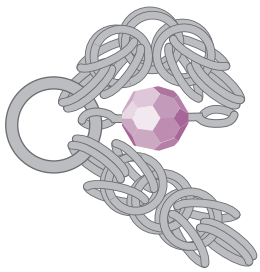


FIG. 2

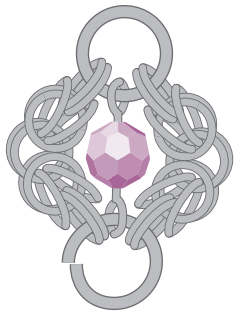


FIG. 3

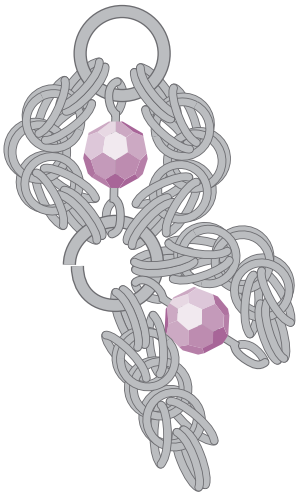


FIG. 4

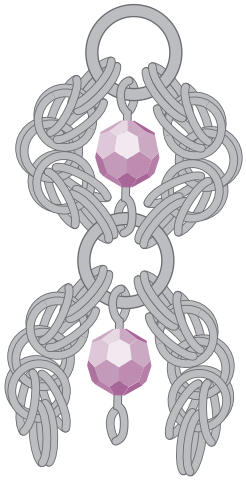


FIG. 5

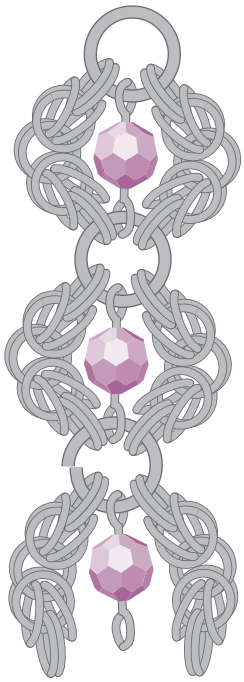


FIG. 6

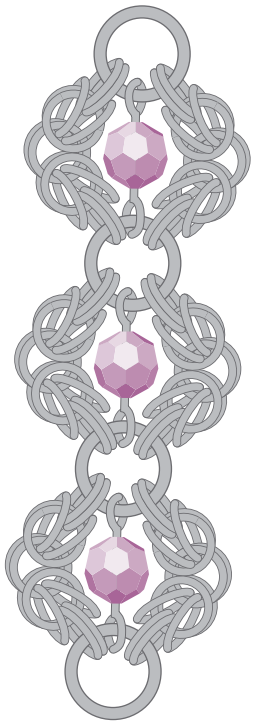


FIG. 7

Byzantine Evil-Eye Bracelet

I call this design the Evil-Eye Bracelet because the blue-crystal Romanov unit in the center resembles the eye motif used in many traditional cultures. Evil-eye beads, charms, symbols, and amulets are believed to protect the wearer from harm, and their use dates back millennia. Wear this one for luck! It is easiest to build this bracelet from the center out.

SUPPLIES

100 sterling silver jump rings, 16g (AWG), 4.5 mm ID

2 sterling silver jump rings, 16g (AWG), 6.0 mm ID

12 sterling silver jump rings, 16g (AWG), 6.5 mm ID

2 sterling silver jump rings (for clasp), 18g (AWG), 3.5 mm ID

1 Swarovski crystal round bead, 8 mm

1 sterling silver eye pin, 2″ (5 cm)

1 sterling silver safety clasp, 18.5 mm

FINISHED LENGTH

6″ (15 cm) not including clasp

To make a longer bracelet, add additional Byzantine points to the ends of the bracelet before attaching the clasp.

Make the Center Unit

1. Make a stand-alone Romanov Unit, following the instructions on page 44, Steps 1–5. Use the 4.5 mm jump rings to make the 2 Byzantine sections and use the 6.0 mm jump rings to gather all the components together on each end.

Weave the Bracelet

2. Make a Byzantine point on each 6.0 mm jump ring of the Romanov Unit, following the Triple-Point Byzantine Unit instructions on page 37, Steps 2–6. Use 6 of the 4.5 mm jump rings to make each point.
3. Build a Flower Unit on each Byzantine point completed in Step 2, following the Byzantine Rose instructions on page 42, Steps 3–5. Use 3 of the 6.5 mm jump rings to make each unit.
4. Using 14 of the 4.5 mm jump rings each, weave a Byzantine segment onto each Flower Unit added in the previous step, following the Byzantine Rose instructions on page 42, Step 6.
5. Build a Flower Unit on each Byzantine section completed in Step 4, following the Byzantine Rose instructions, Steps 3–5. Use 3 of the 6.5 mm jump rings to make each unit.
6. Using 8 of the 4.5 mm jump rings each, weave a Byzantine segment into each Flower Unit completed in the previous step, following the Byzantine Weave instructions on page 32, Steps 1–4.
7. Using 8 of the 4.5 mm jump rings each, weave a Byzantine segment onto each Byzantine segment just added, following the Byzantine Weave instructions, Steps 1–4.

Finish

8. Using the 3.5 mm jump rings, attach the clasp to the ends of the bracelet following the instructions on Attaching Findings to Straight Chain Weaves, page 133.

Spiral Weaves

Spirals exist everywhere—in the shell of a nautilus, the pattern of seeds on a sunflower, the whorl of galaxies in outer space. Perhaps this explains why spiral designs have been used since prehistory and have been found on every continent, save Antarctica, on Earth.

In jewelry design, spiral weaves are flattering and fun to make. The smooth shape moves naturally with the body and feels good on the skin. To form its distinctive geometry, rotate the chain in one direction as you add jump rings. This chapter explores the three most popular spiral-weave variations. Beginners will want to master the single Spiral Chain (page 50) and Double-Spiral Chain (page 52), before moving on to the more challenging—and stunning—Jens Pind Linkage (page 53).

These chain weaves make beautiful necklaces and bracelets. The longer the length of the jewelry, the more spirals to see. And it's easy to design your own unique spiral looks by varying the sizes, textures, and metals within the same piece of jewelry. Or embellish your jewelry as I do in the Double-Spiral Earrings with Pearls (page 56), an elegant accessory that is as quick to make as it is fun.

Spiral Chain

The basic spiral weave, also known as Serpentine, is a 4-in-1 weave, just as the Byzantine weaves we learned in the previous chapter are. The pattern is quite simple: Each jump ring added is woven through the 2 previous links, producing a light, airy twist. Spirals can also be constructed in variations of 6-in-1 (weaving a new jump ring through the previous 3 links) and 8-in-1 (weaving through the previous 4 links), producing denser chains.

The Spiral Chain cannot hold its shape on its own. To wear it, simply twist the chain manually and clasp it in that position. If you want to use this technique for a non-clasped piece of jewelry, try using half-round wire jump rings, which won't slide as easily in the pattern, or weave the ends of the chain together in pattern, forming a closed loop.

Jump-Ring Sizing

METAL	16-GAUGE		18-GAUGE	
	inner diameter	**rings per inch**	**inner diameter**	**rings per inch**
Sterling silver (AWG)	6.0 mm	9	4.0 mm	12
Aluminum (SWG)	¼″	9	3⁄16″	12

I like to use jump rings with an aspect ratio between 4 and 5, but feel free to experiment with the aspect ratio to see how it affects the finished chain.

notes: *I recommend beginning this chain on a starting aid.*

Step-by-step illustrations are provided for right-handed weaving. Left-handers should work in the opposite direction.

Prepare Jump Rings

1. Close 1 jump ring and open the rest. Thread the closed jump ring onto a starting aid (**FIG. 1**).

Weave the Pattern

2. Thread 1 open (purple) jump ring through the first closed (yellow) jump ring and then close it (**FIG. 2**).
3. To properly position the jump rings, rotate the second (purple) jump ring clockwise *or* counterclockwise, forming an opening or "eye" between the 2 jump rings as marked in figure 2. The direction you choose to rotate the jump ring must be maintained throughout the chain and will establish the direction of your spiral.
4. Thread 1 open (orange) jump ring through the eye using a TE connection (page 22) and then close it. Rotate the jump ring in your chosen direction, forming an eye between the 2 jump rings at the end of the chain as shown (**FIG. 3**).
5. Thread 1 open (blue) jump ring through the eye using a TE connection and then close it. Rotate the jump ring in your chosen direction, forming an eye between the 2 jump rings at the end of the chain as shown (**FIG. 4**).
6. Continue threading, closing, and rotating jump rings in this manner until your chain reaches the desired length.

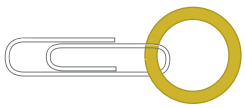


FIG. 1

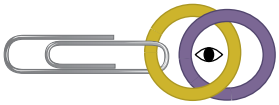


FIG. 2

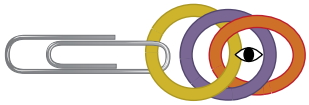


FIG. 3

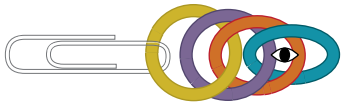


FIG. 4

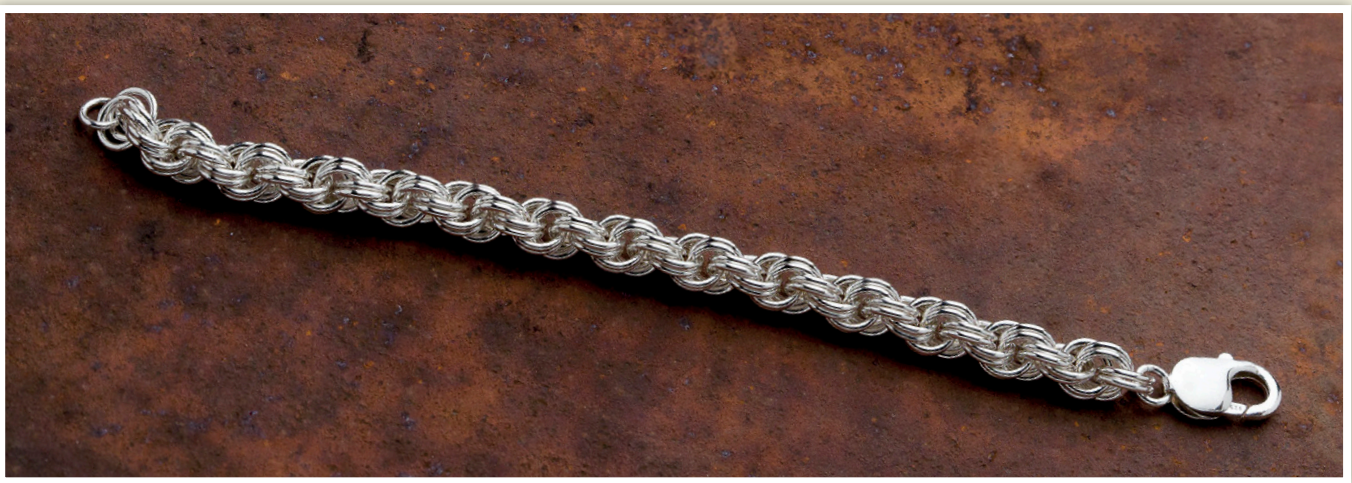
TRY THIS:

Double-Spiral Chain

For a popular take on the simple Spiral Chain, create a Double-Spiral Chain. This chain, also known as a Rope Chain, is denser than the single spiral and holds the spiral twist, whether clasped or on its own. To make, just double the jump rings used: Follow the step-by-step instructions for the Spiral Chain, adding a pair of parallel jump rings at each step instead of a single jump ring. Refer to the chart for recommended Double-Spiral jump-ring sizes.

Jump-Ring Sizing

METAL	16-GAUGE		18-GAUGE	
	inner diameter	**rings per inch**	**inner diameter**	**rings per inch**
Sterling silver (AWG)	6.0 mm	18	5.0 mm	26
Aluminum (SWG)	5/16"	16	7/32"	26



Jens Pind Linkage

Jens Pind Linkage is another 4-in-1 weave in the Spiral Weave family and, because of its tight aspect ratio, forms a spiral that will hold its shape. The Jens Pind Linkage is generally considered to be somewhat difficult to master; I used up a lot of jump rings trying to work out the details of this weave. But don't let this intimidate you! My instructions and step-by-step illustrations show you how to recognize the sweet spot in this weave and how to orient your chain, making it easy to construct.

Jump-Ring Sizing				
METAL	16-GAUGE		18-GAUGE	
	inner diameter	**rings per inch**	**inner diameter**	**rings per inch**
Sterling silver (AWG)	4.0 mm	15	3.0 mm	18
Aluminum (SWG)	3/16"	12	–	–

note: *I recommend beginning this chain on a starting aid.*

Prepare Jump Rings

1. Close 1 jump ring and open the rest. Thread the closed jump ring onto a starting aid.

Start the Weave

The key to proper orientation is to establish the correct direction of your twist by rotating the first 3 jump rings in the weave.

Generally, right-handed people rotate jump rings clockwise and left-handed people rotate jump rings counterclockwise. Work in the direction that is most comfortable for you, as Jens Pind Linkage is dependent on direction.

2. Holding the start of the weave in your nondominant hand, thread 1 open (purple) jump ring through the closed (yellow) jump ring and then close it (**FIG. 1**).

3. To properly position the jump rings, rotate the second (purple) jump ring clockwise (if holding the weave in the left hand) or counterclockwise (if holding the weave in the right), forming an opening or eye between the 2 jump rings as marked in figure 1. The direction you choose to rotate the jump ring at the start of the chain will establish the direction of your spiral.

4. Thread 1 open (orange) jump ring through the eye using a TE connection (page 22) and then close it. Rotate the jump ring in the same direction, forming an eye between the 2 jump rings at the end of the chain as shown (**FIG. 2**).

5. Thread 1 open (blue) jump ring through the eye using a TE connection. It should now lie to the right of the first (yellow) jump ring. If weaving lefty, it should lie to the left of the first jump ring. Pay close attention, as that positioning is crucial! Close the jump ring and *do not let go of the weave yet* (**FIG. 3**).

note: *At this point, it is still difficult to recognize the correct positioning because the jump rings are a bit loose in the weave, which will tighten and stabilize as you add additional jump rings. Consequently, I recommend that you don't put down the chain until you've woven at least a dozen jump rings.*

Weave the Pattern

To weave the pattern, you must thread jump rings through what I call the sweet spot, located just between the (purple/orange) jump rings that cross inside the last (blue) jump ring added (**FIG. 3**). Notice that one jump ring crosses over the other.

For right-handed people, the (orange) jump ring on the right crosses over the top of the (purple) jump ring on the left; the opposite is true for left-handed weavers. The sweet spot lies between these two jump rings, connecting the higher crossed (orange) jump ring and the last (blue) jump ring added, as marked in figure 3. Stay to the right (or left for lefties) of the lower crossed (purple) jump ring, making sure not to catch it. As you place the new jump ring through the sweet spot, the weave will naturally rotate very slightly and will be in perfect position for you to place your next jump ring.

6. Thread 1 open (green) jump ring through the sweet spot using a TE connection and then close it (**FIG. 4**).

7. Thread 1 open (white) jump ring through the sweet spot using a TE connection and close it (**FIG. 5**).

8. Continue working in this manner until the chain reaches the desired length, *checking the weave periodically to ensure proper alignment.*

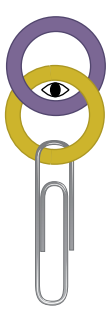


FIG. 1

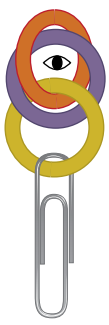


FIG. 2

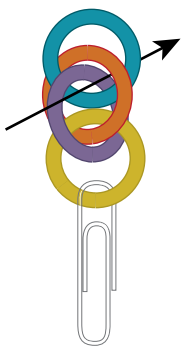


FIG. 3

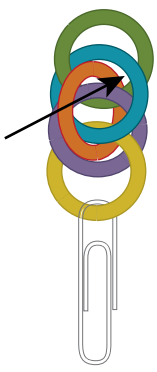


FIG. 4

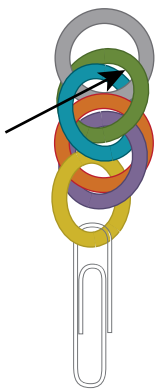


FIG. 5

Don't Flip Out!

The most common mistake when weaving the Jens Pind Linkage is to accidentally flip the weave over and begin weaving on the wrong side. The chain looks almost identical from all sides, making it easy to unintentionally weave on the wrong side. If that happens, you will notice a slight hiccup in the weave pattern where the piece was flipped (**FIG. 6**). It's important to be able to recognize the correct side when, inevitably, you fumble or drop the chain.

Look at **FIGS. 7 AND 8** and you'll notice that the two crossed jump rings sit at slightly different angles below the last jump ring added. In **FIG. 7** (correct), the bottoms of the crossed jump rings curve in toward each other. In **FIG. 8** (incorrect), the bottoms of the crossed jump rings are slightly separated. Make sure you are weaving from the correct side of the weave.

TIP: The first few rings of the weave may shift and cross as you begin to weave. Typically, this hiccup is not noticeable until some length of chain has been woven. Rather than backing out jump rings and starting again, I recommend that you just keep going. Just make the weave a bit longer than needed and then remove the errant jump rings from the beginning of the chain. This simple solution keeps you in the rhythm of weaving and sure beats the frustration of correcting a false start.

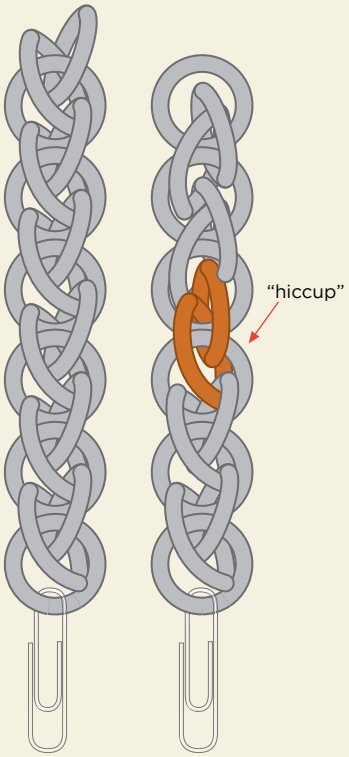


FIG. 6

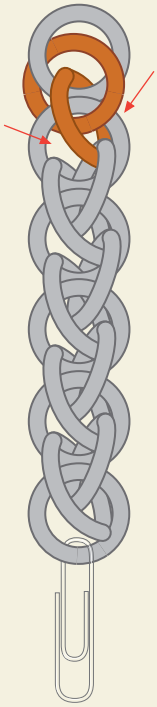


FIG. 7

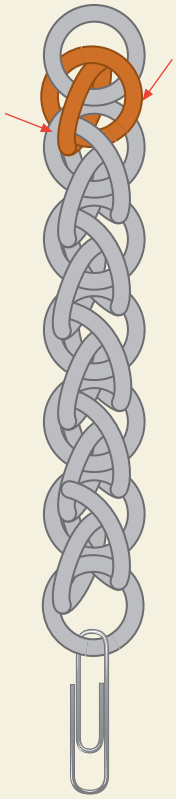


FIG. 8

Double-Spiral Earrings with Pearls

This project gives you an opportunity to see how the direction of the rotation affects the Spiral Weave's twist. The spirals rotate in opposite directions, producing earrings with a pleasing symmetry. To add an additional, elegant touch to these simple earrings, I used pearl drops, but for more glitz and sparkle, you may want to substitute a colorful bead or crystal for the pearl. You could even lengthen the earrings to heighten the drama.

SUPPLIES

36 sterling silver jump rings, 18g (AWG), 4.5 mm ID

4 sterling silver jump rings, 20g (AWG), 2.8 mm ID

2 Swarovski pearl round beads, 6 mm

2 sterling silver head pins

1 pair of sterling silver ear wires

Make the Chain

1. Make 2 segments of Double-Spiral Chain, each using 18 of the 4.5 mm jump rings, following the instructions on page 52. Rotate 1 Double-Spiral segment clockwise and the other counterclockwise to produce 2 mirror-image Double-Spiral segments.
2. Thread each bead onto a head pin and make a wrapped loop (page 137) at the end of each head pin to make the pearl dangles.
3. Attach each pearl dangle to the end of each Double-Spiral segment using a 2.8 mm jump ring.

Finish

4. Attach an ear wire to the opposite end of each Double-Spiral segment using the remaining 2.8 mm jump rings.

European 4-in-1 Weaves

The European 4-in-1 weave is perhaps the most famous chain maille weave of all—the ancient weave used to make protective armor for medieval warriors. If you're a fan of *The Lord of the Rings* movies, you've seen the European 4-in-1 weave.

European weaves consist of adjacent rows of rings oriented in alternating directions. As the 4-in-1 name suggests, each link in the weave passes through 4 others, but variations abound, including 6-in-1, 8-in-1, and King's Maille, which is made by adding jump rings in pairs. The European 4-in-1 weave is a sheet weave and can be expanded in length and width and joined in the round—essential for the shirts, called hauberks, that protected knights of the Middle Ages.

In addition to armor, European 4-in-1 is a fabulous weave for statement jewelry. The weave lends itself to strong pieces such as collars, cuffs, and belts, and it is ideal for watchbands, too. In this chapter, I'll introduce you to some of the basic European 4-in-1 weaving techniques. You are going to learn how to create the basic weave, how to widen it, how to close it from end to end and from side to side, and you'll also learn to use some simple expansion and contraction techniques to make shaped motifs.

European 4-in-1 Sheet Weave

This is the classic sheet weave traditionally used to produce protective battle garments worn by knights and other ancient warriors. European 4-in-1 has two distinct edges, similar to the cut and selvedge edges on a piece of fabric. The grain and stretch of the weave differs from right to left and from top to bottom. You can change the look and drape of a piece of jewelry by simply changing its orientation to take advantage of this property.

Jump-Ring Sizing

METAL	16-GAUGE		18-GAUGE	
	inner diameter	**rings per inch**	**inner diameter**	**rings per inch**
Sterling silver (AWG)	4.0 mm	24	3.5 mm	30
Aluminum (SWG)	3/16"	18	5/32"	27

Prepare Jump Rings

1. Close 4 jump rings and open the rest.

Start the Weave

You are weaving the thinnest sheet possible, 3 jump rings wide.

2. Thread the 4 closed jump rings onto one open jump ring and then close it (**FIG. 1**).
3. Arrange the jump rings on your work surface so that all the jump rings lie flat, as shown in **FIG 2**.

note: *When you pick up the piece to add the next jump ring, the jump rings in your piece will shift, and that can make it difficult to determine how to proceed. Because of that, at this point I recommend that you use masking tape to hold the jump rings in position. Remove the tape when you've woven enough length so that the weave stabilizes itself.*

Weave the Pattern

4. Thread 1 open (orange) jump ring through the 2 (blue) jump rings at the end of the chain and then close it (**FIG. 3**).
5. One at a time, thread 2 open (blue) jump rings through the jump ring just added and close them. Position them as shown in **FIG. 4**.
6. Continue adding jump rings as instructed in Steps 4 and 5 until the weave reaches the desired length, repositioning the jump rings as shown to see where the next jump ring should be placed and to make any errors immediately apparent.

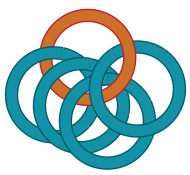


FIG. 1

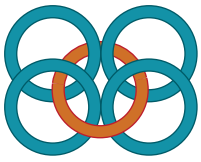


FIG. 2

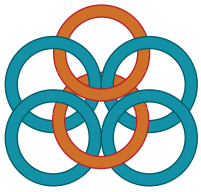


FIG. 3

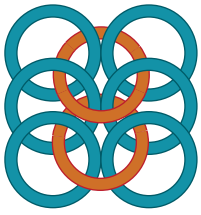


FIG. 4

GET ORIENTED: SPEED WEAVING

As noted with the traditional European 4-in-1 weave technique, I recommend that you use masking tape to hold the jump rings in position when you start the weave. When speed weaving (page 62), it's especially important to mark the tape so you can always identify the correct side from which you'll add jump rings. It's a subtle difference, but one that is worth noticing because an open jump ring must be threaded *over and under* from one side but *under and over* from the other (**FIGS. 6 AND 10**).

The same is true when weaving European 4-in-1 chain maille left-handed.

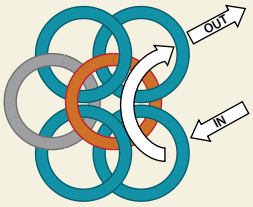


FIG. 6

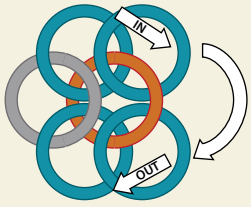


FIG. 10

Speed Weaving European 4-in-1

Whether using large or small jump rings when weaving European 4-in-1, I always prefer to speed weave. Sheet weaves such as this one require lots of jump rings, so time-saving methods are invaluable. Don't forget to use masking tape to stabilize the beginning of this weave!

Prepare Jump Rings

Open one-third and close two-thirds of your jump rings.

Start the Weave

1. Thread 1 open jump ring through 2 closed (blue) jump rings and then close it (**FIG. 1**). Repeat with 3 new jump rings, but do not close the open jump ring (**FIG. 2**).
2. Thread the open jump ring with the 2 closed jump rings on it through the 2 closed (blue) jump rings from Step 1 and then close it (**FIG. 3**).
3. Arrange the jump rings on your work surface so that all the jump rings lie flat and *in the same orientation,* as shown in **FIG. 4**.

Weave the Pattern

4. Thread 1 open jump ring through 2 closed jump rings (**FIG. 5**) and then thread that open jump ring with the 2 closed jump rings on it through the 2 jump rings that are now at the end of the chain, following the path shown in **FIG. 6**. Close the jump ring (**FIG. 7**).
5. Reposition the jump rings as shown in **FIG. 8**, paying close attention to the *orientation* of the piece (see Get Oriented, page 61). Do not flip the weave over.
6. Continue adding jump rings in this manner until the weave reaches the desired length. To end, thread 1 open (yellow) jump ring through the last 2 jump rings at the end of the chain and then close it (**FIG. 9**).

FIG. 1

FIG. 2

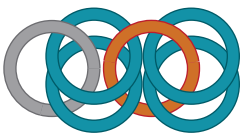


FIG. 3

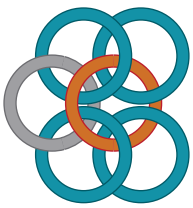


FIG. 4

FIG. 5

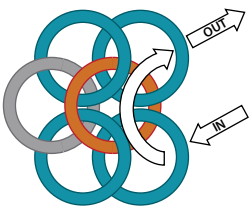


FIG. 6

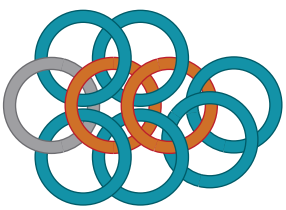


FIG. 7

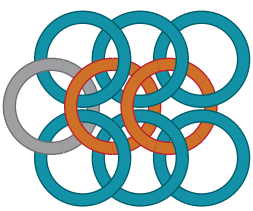


FIG. 8

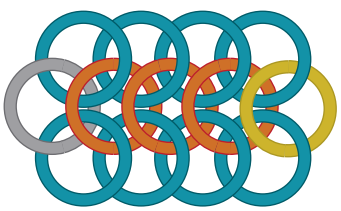


FIG. 9

Widening European 4-in-1 Sheet Maille

The basic European 4-in-1 sheet, just 3 jump rings wide, is versatile and can be used for rings, collars, cuffs, belts, watchbands, and more. But if you'd like to make a piece of statement jewelry, you will most likely want to make these items wider. I find it easier to weave a thin strip to the desired length and then widen it, as opposed to weaving it at the full width. To widen, simply add rows of jump rings to the pairs of jump rings along the edge of the weave.

Make the Base Chain

1. Begin with a length of European 4-in-1 chain maille (page 60).

Add a Row

You are now working on the edge of the weave.

2. Thread 1 open (white) jump ring through the first jump ring on the edge of the chain maille and then close it (**FIG. 1**).
3. Thread 1 open (purple) jump ring straight through the first and second jump rings on the edge of the chain maille using a TE connection (page 22), following the path marked on figure 2. Close the jump ring (**FIG. 2**).
4. Thread 1 open (yellow) jump ring straight through the second and third jump rings on the edge of the chain maille using a TE connection and then close it (**FIG. 3**).
5. Thread 1 open (green) jump ring straight through the third and fourth jump rings on the edge of the chain maille using a TE connection and then close it (**FIG. 4**).
6. Continue threading open jump rings through adjacent pairs of jump rings on the edge of the piece to complete the row. The last jump ring added will thread through just the last jump ring on the edge of the chain maille.

Add Additional Rows

The row of jump rings just added begins and ends with a single jump ring threaded through the first and last jump rings on the chain (Steps 2 and 6). If you want to widen the weave further, you will omit these steps and weave as follows:

7. Begin the next row by threading a jump ring through the first and second jump rings on the chain maille and then add jump rings following Steps 4 and 5. End the row by threading a jump ring through the last 2 jump rings on the chain maille.

note: *Single rings are required at the beginning and ending of every other row to maintain the weave pattern, so odd-numbered rows will have the same number of jump rings in the same orientation, and even-numbered rows will have the same number of jump rings in the same orientation.*

8. Continue adding rows until the weave reaches the desired width.

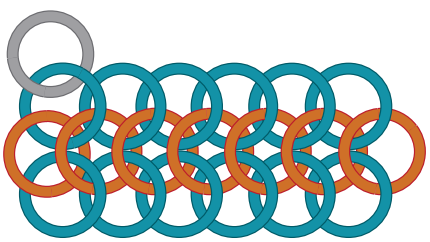


FIG. 1

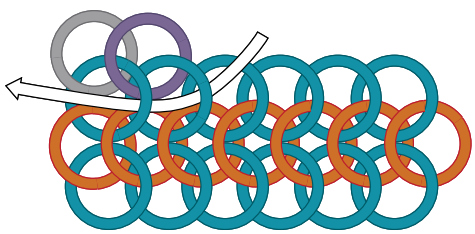


FIG. 2

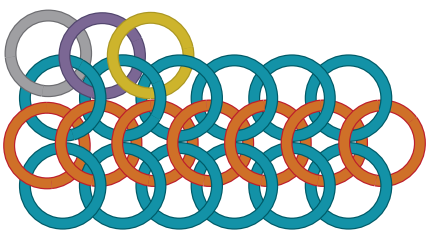


FIG. 3

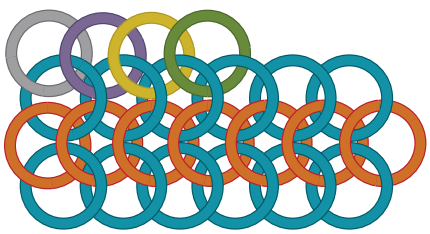


FIG. 4

TIP: Keep in mind when designing that with an odd number of rows, the jump rings along each outer edge will lie in the same direction. With an even number of rows, the jump rings along each edge will lie in opposite directions.

European 4-in-1 Ring, or Closing a Tube from End to End

I like to teach ring making to illustrate how to close European 4-in-1 chain maille from end to end and how to widen a closed band or tube shape. The jump rings used to make this ring are extremely tiny and well suited for experienced chain maille jewelers. Chain maille of this scale is called micromaille. For beginners, I suggest practicing the technique with larger jump rings. In my classes, students make their first ring using 16-gauge, 3⁄16″ (4.76 mm) inner diameter aluminum jump rings. Those with more experience may want to start with 20-gauge, 2.75–2.8 mm inner diameter sterling silver jump rings (about 5 jump rings per row for ½″ (1.3 cm) of length.

Jump-Ring Sizing		
METAL	22-GAUGE	
	inner diameter	**rings per ½″**
Sterling silver (AWG)	2.0 mm	about 7 jump rings per row × number of rows (see Ring Sizing)

note: *I recommend using masking tape to stabilize the start of the weave.*

Make the Base Chain

1. Make a European 4-in-1 base chain 3 rows wide and long enough to reach the desired circumference, following the instructions on page 62. The base chain should begin and end with a single jump ring.

note: *Before closing the ring, place the base chain around your knuckle to check for a comfortably snug fit and to ensure that the single rings at the end of the base chain overlap. You may need to add a few extra jump rings if you plan to make a wide ring, as a wide band requires a bit of extra length (about half a millimeter) to fit over the knuckle.*

Closing the Ring

2. Bring both ends around to meet, but *do not twist the band* (**FIG. 1**).
3. Let the first and last jump rings at each end overlap, forming an eye as marked in **FIG. 2**.
4. Thread 1 open (green) jump ring through the eye at the ends of the band. Make sure to follow the angle of the existing jump rings on the edge of the band. Close this jump ring (**FIG. 3**).
5. Thread and close 1 open (purple) jump ring through the eye on the opposite edge of the band in the same way as Step 4 (**FIG. 4**).

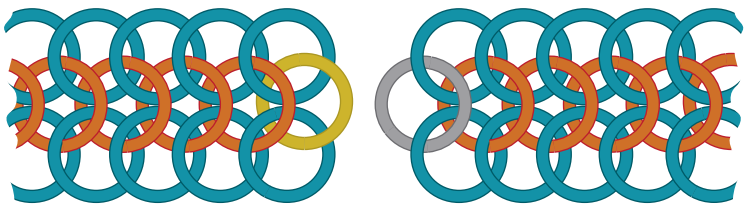


FIG. 1

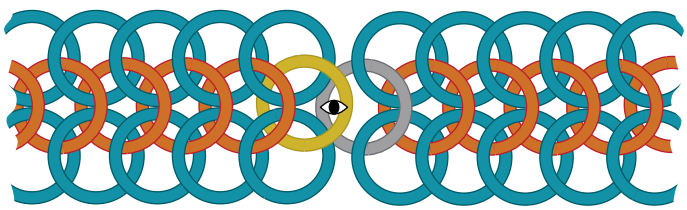


FIG. 2

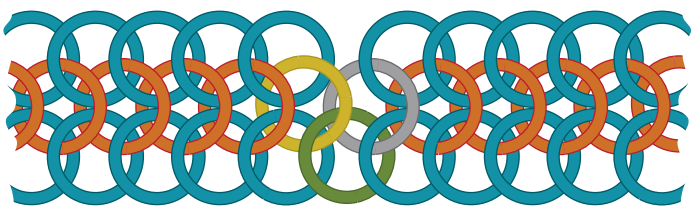


FIG. 3

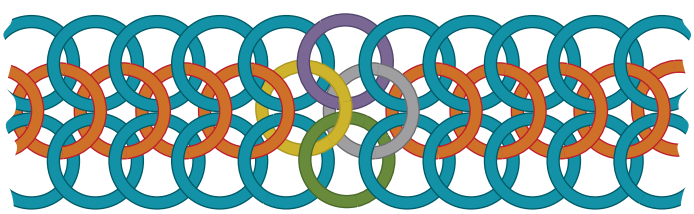


FIG. 4

TIP: Starting the weave with jump rings of this size can be challenging. Just make the base chain longer than necessary and then detach the chain at the correct length and set aside the extra base chain to start your next ring.

RING SIZING

Measure your finger at the widest part (the knuckle) to determine the desired ring circumference. Calculate this measurement in half inches. Using the Jump-Ring Sizing Chart, multiply the number of jump rings needed per half inch.

For example, to make a 9-row band that fits a knuckle measuring 2½" (6.5 cm), you'll need about 63 jump rings *per half inch* (7 jump rings per row x 9 rows):

2½" = 5 half inches

5 half inches x 63 jump rings = 315 jump rings needed

Widening a Closed Ring

Widening a tube-shaped piece that was closed using the end-to-end method is very similar to widening a flat sheet. You simply add additional rows to the edge of your ring by weaving jump rings through pairs of jump rings on the edge of the band.

Make the Closed Ring

1. Begin with a closed European 4-in-1 ring (page 64).

Add a Row

You are now working on the edge of the band. Pick any spot to begin.

2. Thread 1 open (yellow) jump ring straight through 2 jump rings on the edge of the band using a TE connection (page 22) as marked in **FIG. 1**, now called the 1st and 2nd jump rings. Close the jump ring.
3. Thread 1 open (green) jump ring straight through the 2nd and 3rd jump rings on the edge of the band using a TE connection and then close it (**FIG. 2**).
4. Thread 1 open (purple) jump ring straight through the 3rd and 4th jump rings on the edge of the band using a TE connection and then close it (**FIG. 3**).
5. Continue in this manner to complete the row. The last jump ring added will thread through the last and first jump rings on the edge of the band (**FIG. 4**).
6. Continue adding rows until the band reaches the desired width.

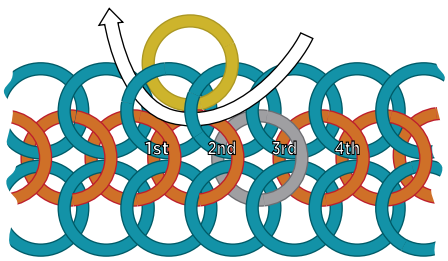


FIG. 1

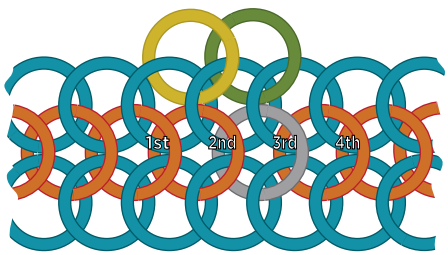


FIG. 2

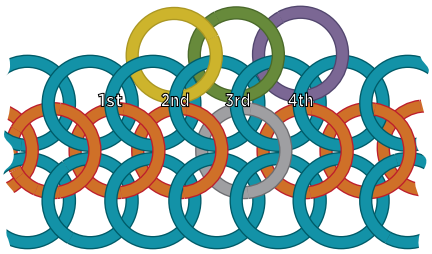


FIG. 3

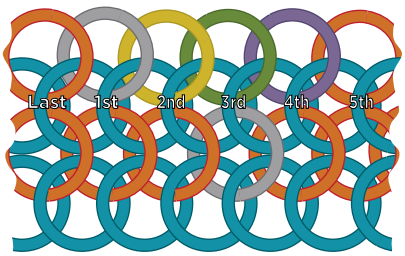


FIG. 4

European 4-in-1 Round Maille, or Closing a Tube from Side to Side

Closing European 4-in-1 chain maille from side to side is another way to form a tube and produces a completely different look to the weave. (Note the differences in the rings shown in If at First You Don't Succeed, page 69. The left and center rings were closed end to end and the right ring was closed side to side.) When you close a 5-jump-ring wide sheet of European 4-in-1 maille in this way, you magically make Round Maille. You can weave a sheet of this size in one of the following ways: by making a basic 3-row sheet (page 60) and adding 2 additional rows to widen it (page 63), or you can weave it in the following pattern, which will help you understand the weave from a different perspective, expanding your choices when designing jewelry.

Jump-Ring Sizing				
METAL	16-GAUGE		18-GAUGE	
	inner diameter	**rings per inch**	**inner diameter**	**rings per inch**
Sterling silver (AWG)	5.0 mm	45	3.5 mm	60
Aluminum (SWG)	7/32"	39	3/16"	42

note: *Although this technique forms round maille, it is not the method I prefer to use when constructing a round maille chain. The Round Maille Weave method I prefer and its variations are demonstrated later in the book (page 89).*

TUBULAR EUROPEAN 4-IN-1

European 4-in-1 has been used for centuries to make armor, and no artisan would have labored without learning how to form the weave in tube shapes, essential for the sleeves of hauberks (maille shirts), for example. For jewelry, tubes make great cuff bracelets, statement neckpieces, and rings. I also like to make pendant bails out of tube shapes.

You can make a tube by joining a sheet of European 4-in-1 from end to end (page 64) or from side to side. The two techniques yield clear differences in style. The method you choose is dependent on your preferred design and its intended purpose.

Prepare Jump Rings

1. Close 4 jump rings (to be used in starter chain) and open the rest.

Start the Weave

2. Make a 2-1-2-1-2 chain, following the instructions on page 26. Arrange the chain on your work surface so that the jump rings lie flat and in the same direction as shown in **FIG. 1**. You now have a 3-row chain that is 5 jump rings wide. For a wider sheet, modify the length of your starting chain, using an odd number of jump rings to keep the weave symmetrical.

Weave the Pattern

3. Thread 1 open (purple) jump ring through the right and center jump rings of row 3 and then close it (**FIG. 2**).

4. Thread 1 open (white) jump ring through the left and center jump rings of row 3 and then close it. You have just completed row 4, which is comprised of 2 center jump rings (**FIG. 3**).

5. Thread 1 open (yellow) jump ring through the 2 jump rings of row 4, and then close it (**FIG. 4**).

6. Thread and close 1 open (green) jump ring through the right jump ring of row 4 and then thread and close 1 open (green) jump ring through the left jump ring of row 4. You have just completed row 5, which is comprised of 3 jump rings (**FIG. 5**).

7. Continue adding jump rings in this manner (adding alternating rows of 2 jump rings and 3 jump rings), following Steps 3–6 until the chain maille reaches the desired length, referring to the tips for traditional European 4-in-1 weaving (page 60).

note: *Remember this pattern of adding alternating rows of 2 and 3 jump rings, as it will be repeated when you are learning how to construct the basic Dragonscale Weave (page 119).*

Close the Tube

8. Roll the European 4-in-1 piece side to side (not end to end) to form a tube (**FIGS. 6 AND 7**). Note that the side jump rings form nested Vs (**FIG. 8**).

9. Begin at the pointy end of the Vs. Thread an open (white) jump ring through the left- and right-side jump rings 1 and 2 using TE connections (page 22), as marked in **FIG. 8**. Close the jump ring (**FIG. 9**).

note: *The jump ring just added threads through 4 side jump rings, as this is a tubular form of European 4-in-1.*

10. Thread an open (green) jump ring through the left- and right-side jump rings 2 and 3 using TE connections. Close the jump ring. This jump ring shares 2 side jump rings with the jump ring added in Step 9 (**FIG. 10**).

11. Continue adding jump rings in this manner until the tube is closed.

TRY THIS:

BOX CHAIN

Box chain is in the European family of weaves, so it is possible to make a Box Chain by closing a sheet of European 4-in-1 maille that is only 3 jump rings wide (page 60), using the side-to-side closing method. Use the Jump-Ring Sizing Chart, page 38, to determine the proper aspect ratio for the jump rings.

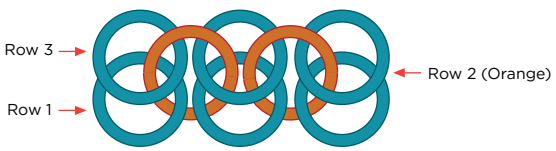


FIG. 1

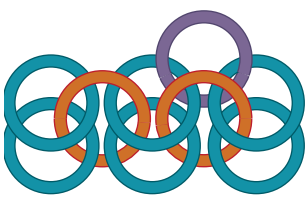


FIG. 2

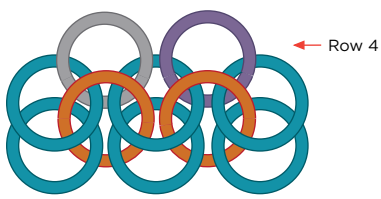


FIG. 3

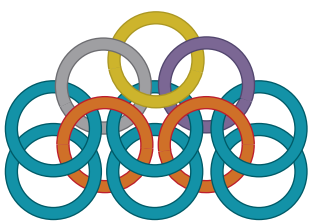


FIG. 4

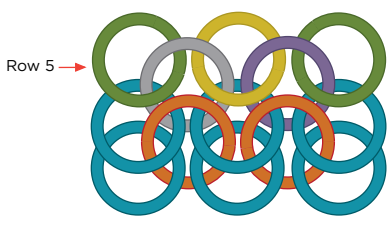


FIG. 5

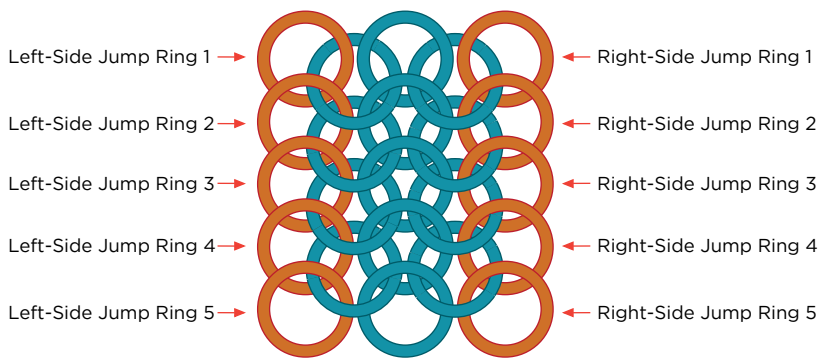


FIG. 6

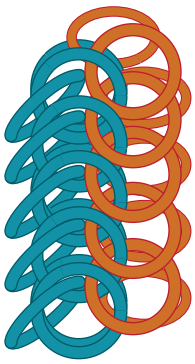


FIG. 7

FIG. 8

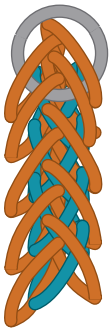


FIG. 9

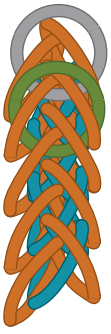


FIG. 10

IF AT FIRST YOU DON'T SUCCEED . . .

I love rings. As I write this, I've got a ring on almost every finger! So when I saw pictures of European 4-in-1 rings online, I knew I wanted to duplicate the look myself. The most specific instructions I could find simply said to construct a band to the desired size and then weave the ends together. So I settled on a jump-ring size, made my piece, and then I tried to close it. But closing end to end requires you to insert jump rings into the weave in pattern, incorporating both ends seamlessly. It was extremely difficult to weave into the center of the strip, especially using such small jump rings, and it took me several frustrating hours to complete the end-to-end closure. My band was only 5 jump rings wide, and, once closed, I wished it were wider, but there was no way I was going to take it apart and start again!

Closing side to side is a bit easier, just like closing up a seam. So I decided to try weaving a wider ring oriented from side to side instead. It *was* easier to close, but I did not like the edge produced when weaving in this direction. The jump rings lie horizontally and tend to catch on clothing and hair. I was always making repairs to that ring.

All three rings were made using 22-gauge, 2.0 mm ID sterling silver jump rings.

Suddenly one day, it hit me. Weave the thinnest end-to-end strip possible, so that the closing point is easily accessible. When closed, simply *weave around the edges* to make the ring to the desired width.

European 4-in-1 Shapes

Our bodies aren't shaped like squares, so why should chain maille be? Knowing how to expand and contract weaves is a valuable skill; it is necessary to produce body-hugging armor and will help broaden your jewelry design choices. Diamond and leaf shapes are perfect for earrings, pendants, and bails. You can even combine the shaping techniques that follow to create unique pieces of your own design.

Jump-Ring Sizing

METAL	16-GAUGE		18-GAUGE	
	inner diameter		inner diameter	
	Diamond	Leaf	Diamond	Leaf
Sterling silver (AWG)	4.0 mm (7 rows/inch)	4.5 mm* (6 rows/inch)	3.0 mm (10 rows/inch)	3.5 mm* (8 rows/inch)
Aluminum (SWG)	3/16" (6 rows/inch)	7/32"* (5 rows/inch)	–	5/32"* (7 rows/inch)

***Plus 1 jump ring to gather end, 3–4 mm ID larger.**

notes: *Diamond shapes are constructed of slightly smaller jump rings than leaf shapes to produce a tight weave with crisp edges. Leaf shapes are made from larger jump rings, as more movement is required to allow the final row to be gathered.*

I recommend beginning this chain on a starting aid.

Prepare Jump Rings

1. You can make these shapes as big or small as you want, so you need to decide how many jump rings you will need.

   For the Diamond Shape: Close 2 jump rings and open the rest.

   For the Leaf Shape: Close 2 jump rings and open the rest. Open the large jump ring (for gathering) and set aside.

Make the First 2 Rows

2. Thread 1 open jump ring onto the starting aid and then through 2 closed jump rings. Close the jump ring. Arrange the jump rings on your work surface as shown in **FIG. 1**. These are the first two rows.

note: *Row 1 is comprised of 1 jump ring, row 2 of 2 jump rings, and so on.*

Make Row 3

3. Thread 1 open jump ring straight through jump rings 1 and 2 of row 2 using a TE connection (page 22), as marked in **FIG. 2**. Close the jump ring.

4. Thread and close 1 open jump ring through jump ring 1 of row 2 (stay on the outside edge). Then thread and close 1 open jump ring through jump ring 2 of row 2 (stay on the outside edge) (**FIG. 3**).

Make Subsequent Rows

The technique used to make subsequent rows is similar to Widening European 4-in-1 Sheet Maille, page 63. The difference is that for *each* row added, we will add single jump rings to the first and last jump rings on that row, causing the expansion of each subsequent row.

5. Thread 1 open jump ring straight through jump rings 1 and 2 of the previous row using a TE connection and then close it.

6. Thread 1 open jump ring straight through jump rings 2 and 3 of the previous row using a TE connection and then close it (**FIG. 4**).

7. Continue in this manner until you have woven a new jump ring through pairs of adjacent jump rings along the entire length of the previous row.

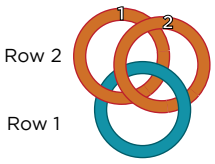


FIG. 1

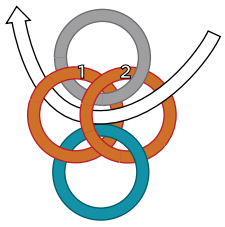


FIG. 2

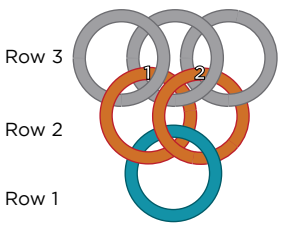


FIG. 3

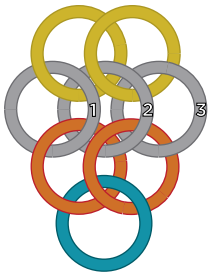


FIG. 4

SHAPE UP

To expand European 4-in-1 when you are making a leaf shape, add single jump rings on every row end. To contract, do not add these end rings at all, as in finishing a diamond shape. To maintain a constant width, add the single rings to every other row end, just as when widening a flat sheet (page 63). You also can change the shape of a piece by adding or omitting jump rings in the interior of a row. Varying the size of jump rings (i.e., graduated sizes) is another way to affect the shape of a weave. These techniques offer myriad design possibilities.

8. Thread and close 1 open jump ring through the leftmost jump ring of the previous row (stay on the outside edge). Then thread and close 1 open jump ring through the rightmost jump ring of the previous row (stay on the outside edge) (**FIG. 5**).

9. Repeat Steps 5–8 until the shape reaches the desired width.

Finishing the Shapes

10. Finish each shape as follows.

    For the Leaf Shape: Thread the large open jump ring set aside in Step 1 through all the jump rings on the top row and then close it (**FIG. 6**).

    For the Diamond Shape: Attach a new jump ring straight through each pair of adjacent jump rings (1 and 2, 2 and 3, 3 and 4, and so on) along the previous row, using TE connections (**FIG. 7**). Repeat to finish each new row of jump rings added (**FIGS. 8 AND 9**).

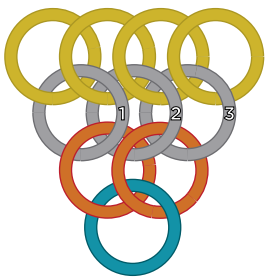


FIG. 5

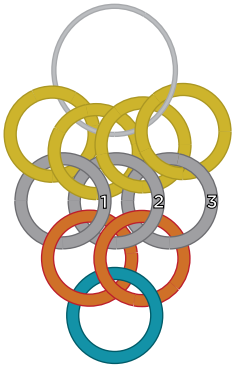


FIG. 6

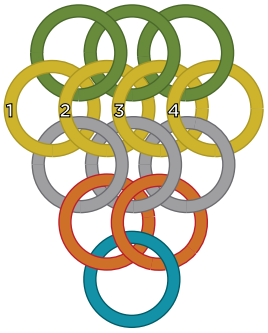


FIG. 7

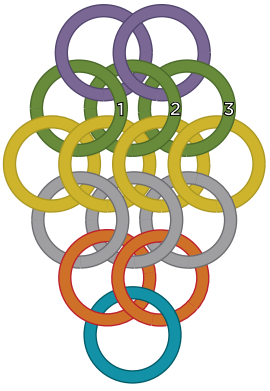


FIG. 8

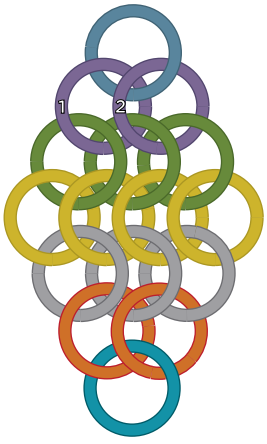


FIG. 9

Graduated European 4-in-1 Chain Necklace

The focal point of this necklace is a section of European 4-in-1 that is suspended by several strands of premade sterling silver cable chain. Inspired by a look that I saw a celebrity sporting on television, this necklace reminds me of how truly adaptable chain maille can be. I used graduated jump rings to add a flared shape to the weave and gathered the ends of the cable chains in a single clasp. If you'd like the strands to have more separation, use a multi-strand clasp.

SUPPLIES

For European 4-in-1:

9 sterling silver jump rings, 18g (AWG), 3.0 mm ID

8 sterling silver jump rings, 18g (AWG), 3.5 mm ID

9 sterling silver jump rings, 18g (AWG), 4.0 mm ID

8 sterling silver jump rings, 18g (AWG), 4.5 mm ID

9 sterling silver jump rings, 18g (AWG), 5.0 mm ID

8 sterling silver jump rings, 18g (AWG), 5.5 mm ID

9 sterling silver jump rings, 16g (AWG), 6.0 mm ID

8 sterling silver jump rings, 16g (AWG), 6.5 mm ID

7 sterling silver jump rings, 16g (AWG), 7.0 mm ID

For making connections:

8 sterling silver jump rings, 20g (AWG), 2.8 mm ID

4 sterling silver jump rings, 16g (AWG), 4.0 mm ID

56″ (142 cm) sterling silver oval cable chain, 4.6 mm OD

1 sterling silver lobster clasp, 18 mm

FINISHED LENGTH

14½″ (37 cm) not including clasp

Weave the Center

1. Make a 3-row European 4-in-1 base chain, following the European 4-in-1 instructions on page 60. Use 3.0 mm and 4.0 mm jump rings to form the left and right edges of the weave, respectively, and 3.5 mm jump rings to form the center row.
2. Add subsequent rows to the right, 4.0 mm side of the base chain, following the Widening European 4-in-1 instructions on page 63. Add the first row using 4.5 mm jump rings and continue adding rows using progressively larger jump rings, ending with 7.0 mm jump rings.

note: *When adding the rows of 8 or 7 jump rings, skip the first and last steps requiring you to add a single jump ring to the first and last jump ring of each row.*

Add the Cable Chain

The cable chain connects to the European 4-in-1 rows that are 8 jump rings long.

3. Cut 2 lengths of the cable chain, each 7″ (18 cm) long. Count the number of links in the cut chain.
4. Cut 6 lengths of chain as follows:

   Cut 2 lengths of chain, each 2 links shorter than the 7″ (18 cm) chain.

   Cut 2 lengths of chain, each 1 link shorter than the chain just cut.

   Cut 2 lengths of chain, each 1 link shorter than the previous chain just cut.

5. Using the 2.8 mm jump rings, connect the lengths of cable chain to the European 4-in-1 section as follows:

   Connect the longest lengths of cable chain to the first and last 6.5 mm jump rings.

   Connect the second longest lengths of cable chain to the first and last 5.5 mm jump rings.

   Connect the third longest lengths of cable chain to the first and last 4.5 mm jump rings.

   Connect the shortest lengths of cable chain to the first and last 3.5 mm jump rings.

Finish

6. Thread 1 open 4.0 mm jump ring through the loose ends of the cable chain on one side of the necklace and then close it.
7. Thread another open 4.0 mm jump ring through the jump ring just added and the lobster clasp and then close it (**FIG. 1**).
8. Thread 1 open 4.0 mm jump ring through the loose ends of the cable chain on the other side of the necklace and through 1 closed 4.0 mm jump ring (the catch for the clasp). Close the jump ring (**FIG. 2**).

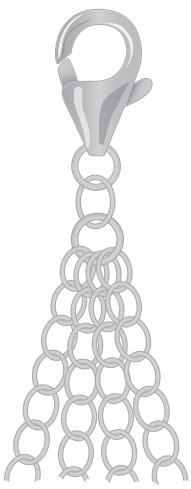


FIG. 1

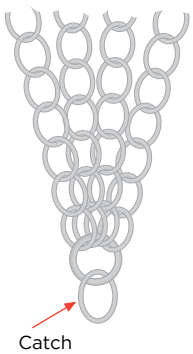


FIG. 2

Parallel Chain Weaves

The Parallel Chain Weave is a hybrid that adapts elements of Japanese weaves and Orbital Captive weaves into a unique linking pattern that uses two sizes of jump rings. Jump rings aligned horizontally link to those aligned vertically (a characteristic of the Japanese weave family), and some of the jump rings in the Parallel Weave are sandwiched between other jump rings (captive) while simultaneously orbiting other jump rings in the weave (orbital). Although these orbital captive jump rings do not actually link through any other jump rings, they are held in place in the weave, which is what makes orbital captives so cool!

This chapter presents the basic Parallel Weave along with three variations for speed weaving. With so many choices in technique, you'll be sure to find the one that suits you best. The strong linear pattern is well suited for masculine jewelry pieces, especially when constructed in heavier gauges, such as 14- or 16-gauge. The Parallel Flower Unit (page 83) technique creates beautiful swirls of chain for linking or for joining with other weaves.

The Parallel Weave also shines when different types of jump rings, such as twisted wire, are used, as in the Parallel Twist Earrings (page 86). Design options abound—in color and type of jump rings used—and the weave's empty spaces along its edges are perfect places for bead dangles or charms. Its flat profile makes it possible to connect rows of Parallel chains together to form sheets.

Parallel Chain Weave

The Parallel Chain's name reflects the parallel arrangement of the large jump rings in the weave. It is also called Helm Chain, a name derived from the weave's Nordic origins. There are many different ways to construct the Parallel Chain. I've included instructions for the traditional Parallel Weave and three different methods for speed weaving, to give you many choices and perspectives to view the weave. Give them all a try to see which one you like best. You may discover additional methods of your own.

Jump-Ring Sizing

METAL	16-GAUGE		18-GAUGE	
	inner diameter	**rings per inch**	**inner diameter**	**rings per inch**
	large (small)	**large (small)**	**large (small)**	**large (small)**
Sterling silver (AWG)	7.0 mm (4.5 mm)	8 (4)	6.0 mm (3.5 mm)	10 (8)
Aluminum (SWG)	3/8" (7/32")	6 (4)	5/16" (5/32")	7 (4)

note: *I recommend beginning this chain on a starting aid.*

Prepare Jump Rings

1. Open all small jump rings. Close 2 large jump rings and open the rest.

Start the Weave

2. Thread 2 small open jump rings through 2 large closed jump rings, and then close them (**FIG. 1**).
3. Attach a starting aid to the large jump rings, if using (**FIG. 2**).

Weave the Pattern

4. Pass 1 large (blue) open jump ring between the 2 large (white) closed jump rings so that it surrounds the 2 small jump rings without linking through them. Close the jump ring (**FIG. 3**). You have just added your first orbital jump ring.

note: *The (blue) jump ring just added passed between the large (white) jump rings but was not threaded through the centers. This jump ring sits parallel to the large (white) jump rings, hence the name Parallel Weave.*

5. Thread 1 large (yellow) jump ring through the 2 small closed jump rings and then close it, making sure that the jump ring just added lies to one side of the chain (**FIG. 4**). The other side of the chain will be empty.
6. From the other side of the chain, thread another large (orange) open jump ring through the 2 small closed jump rings and then close it (**FIG. 5**). You have just captured the (blue) orbital jump ring, creating an orbital captive jump ring.
7. Thread 2 small open jump rings through the 2 large closed jump rings at the end of the chain (yellow and orange) and then close them (**FIG. 6**).
8. Repeat Steps 4–7 until the chain reaches the desired length, ending after Step 6.

TIP: You can use any of the methods for weaving the Parallel Chain to start the Dragonscale Weave (page 119). Just substitute single small jump rings for the pairs of small jump rings used in the Parallel Chain instructions.

FIG. 1

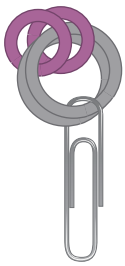


FIG. 2

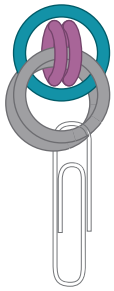


FIG. 3

FIG. 4

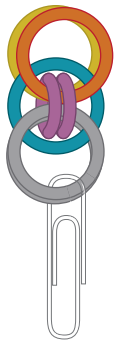


FIG. 5

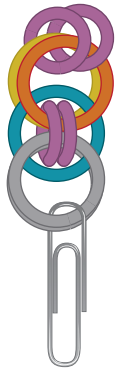


FIG. 6

Speed Weaving Parallel Chain

The Parallel Chain Weave presents many different methods of construction—including speed weaving. Practice all three of the following methods to find the one that works best for you. Method A is the closest to the traditional weave and the easiest to master. However, it is slower than those that follow, as fewer pre-closed jump rings are used. The second method is a bit more complicated but faster to construct, making it my favorite. The third way is most like the start of Dragonscale and provides yet another perspective on the weave.

Method A

This method most closely resembles the traditional parallel weave technique. In this method of speed weaving, pre-closed jump rings are the orbital captive jump rings, sandwiched among the jump rings threaded throughout the weave.

Prepare Jump Rings

1. Open the small jump rings. Close about one-third of the large jump rings and open the rest.

Start the Weave

2. Attach 2 large (white) closed jump rings to a starting aid (**FIG. 1**).
3. Place a large (blue) closed jump ring between the 2 large (white) jump rings attached to the starting aid (**FIG. 2**).

note: *This (blue) jump ring is the first orbital jump ring.*

4. Working in the center of the large (blue) jump ring just added, thread a small open jump ring through the 2 large (white) jump rings attached to the starting aid and then close it. Repeat with a second small open jump ring (**FIG. 3**).

Weave the Pattern

5. Thread 1 large (yellow) jump ring through the 2 small closed jump rings and then close it, making sure that the jump ring just added lies to one side of the chain (**FIG. 4**). The other side of the chain will be empty.
6. From the other side of the chain, thread another large (orange) open jump ring through the 2 small closed jump rings and then close it (**FIG. 5**). You have just captured the (blue) orbital jump ring, creating an orbital captive jump ring.
7. Place a large (purple) closed jump ring between the 2 large (yellow and orange) jump rings just added (**FIG. 6**).
8. Working in the center of the large (purple) jump ring just added, thread a small open jump ring through the 2 large (yellow and orange) jump rings previously added and then close it. Repeat with a second small open jump ring (**FIG. 7**).
9. Repeat Steps 5–8, until the chain reaches the desired length, ending after Step 6.

FIG. 1

FIG. 2

FIG. 3

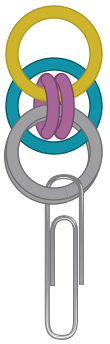


FIG. 4

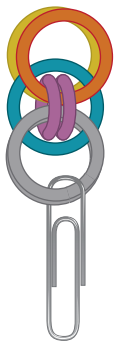


FIG. 5

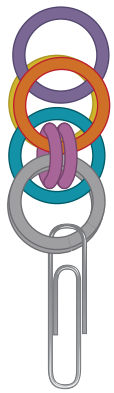


FIG. 6

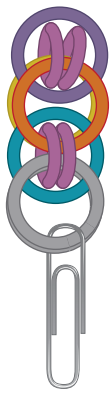


FIG. 7

Method B

In this method of speed weaving, all of the large jump rings are pre-closed except the orbital captive jump rings—which is opposite of the technique used in Method A. Some people find using open orbital captive jump rings a bit tricky; however, this method is quicker because it uses more pre-closed jump rings.

Prepare Jump Rings

1. Open all small jump rings. Open about one-third of the large jump rings and close the rest.

Start the Weave

2. Thread and close first 1 and then a second small open jump ring through 4 large closed jump rings (**FIG. 1**).
3. Attach 2 of the large jump rings to a starting aid, and arrange as shown in **FIG. 2**.
4. Pass 1 large (white) open jump ring between the 2 large closed jump rings attached to the starting aid so that it surrounds the 2 small jump rings without linking through them, as marked in **FIG. 2**. Close the jump ring (**FIG. 3**). You have just added your first orbital jump ring, held captive between 4 large jump rings.

Weave the Pattern

5. Thread a small jump ring through the 2 large jump rings at the end of the chain. Do not close it (**FIG. 4**).
6. Thread 2 large closed jump rings onto the small jump ring. Now there are 4 large jump rings in the small jump ring (**FIG. 5**). Close the small jump ring.
7. Thread and close another small jump ring around these 4 large closed jump rings (**FIG. 6**).
8. Pass 1 large (white) open jump ring between the 2 large closed jump rings previously added so that it surrounds the small jump rings without linking through them, as marked in **FIG. 6**. Close the jump ring (**FIG. 7**).
9. Repeat Steps 5–8 until the chain reaches the desired length.

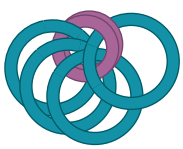


FIG. 1

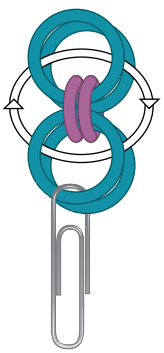


FIG. 2

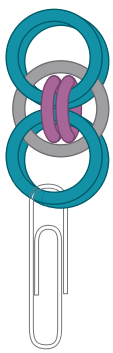


FIG. 3

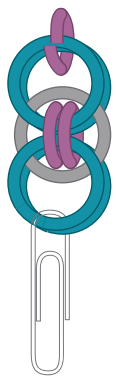


FIG. 4

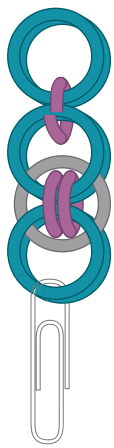


FIG. 5

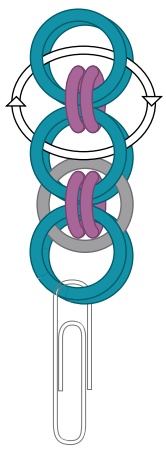


FIG. 6

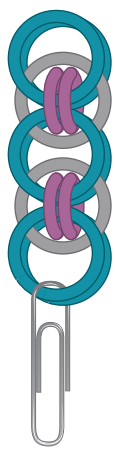


FIG. 7

Method C

In this method of speed weaving, a base chain is first constructed to the desired length, and the subsequent layers are added along the length of the chain. The orbital captive jump rings and half of the large outer jump rings are pre-closed. This method most resembles the start of the Dragonscale weave (page 119).

Prepare Jump Rings

1. Open all small jump rings. Open about one-third of the large jump rings and close the rest.

Start the Weave

2. Thread and close first 1 and then a second small jump ring through 2 large closed jump rings and arrange them as shown (**FIG. 1**). Set aside.

Build the Base Chain

3. Thread a small open jump ring through 1 large closed jump ring (**FIG. 2**). Then thread the small open jump ring through 1 large closed jump ring on the end of the piece set aside in Step 1. Close the open jump ring (**FIG. 3**).
4. Thread another small open jump ring through the same 2 large jump rings and close it (**FIG. 4**).
5. Repeat Steps 3 and 4 until the base chain reaches the desired length (**FIG. 5**).

Add the Captive Jump Rings

6. Place 1 large (orange) closed jump ring over the first pair of small jump rings and another large (orange) closed jump ring over the second pair of small jump rings (**FIG. 6**).
7. Thread and close a large (gray) open jump ring through the 2 sets of small jump rings in the centers of the first and second captive jump rings. This action captures and stabilizes the orbiting (orange) jump rings (**FIG. 7**).
8. Place 1 large (yellow) closed jump ring over the next small pair of jump rings (**FIG. 8**).
9. Thread and close a large (green) open jump ring through the 2 sets of small jump rings in the centers of the second and third captive jump rings (**FIG. 9**).
10. Continue in this manner until you reach the end of the chain. Thread a large open jump ring through each set of small jump rings at the beginning and end of the chain (**FIG. 10**).

FIG. 1

FIG. 2

FIG. 3

FIG. 4

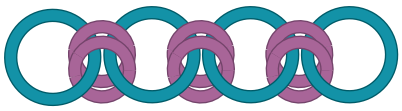


FIG. 5

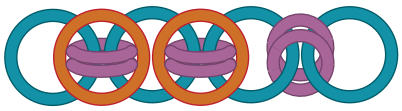


FIG. 6

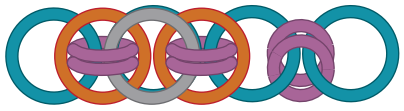


FIG. 7

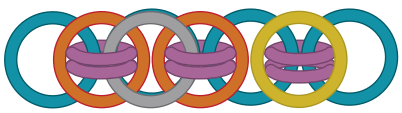


FIG. 8

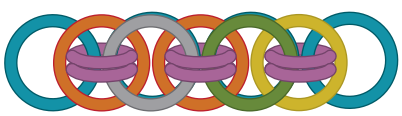


FIG. 9

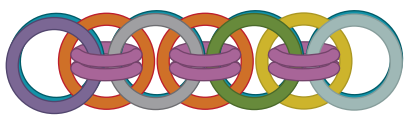


FIG. 10

Parallel Flower Unit

A popular application of the Parallel Chain is to use it to construct these sweet flowers. The flowers offer a wide range of design options and give this weave a feminine flair. They can be used alone as earrings or delicate pendants, connected in a linear fashion to form chains for necklaces and bracelets or connected geometrically to form interesting motifs. They are often combined with other weaves and units to create unique chain designs. The open spaces on the edges of the flowers provide room to add beads, crystals, pearls, charms, and other embellishments.

Jump-Ring Sizing

METAL	16-GAUGE		18-GAUGE	
	inner diameter	**rings per unit**	**inner diameter**	**rings per unit**
	large (small)	**large (small)**	**large (small)**	**large (small)**
Sterling silver (AWG)	–	–	6.0mm (3.5mm)	12 (8)
Aluminum (SWG)	3/8″ (7/32″)	12 (8)	5/16″ (5/32″)	12 (8)

Make the Base Chain

1. Make a piece of Parallel Chain using 11 large jump rings and 6 small jump rings, following the instructions on page 78 (**FIG. 1**).
2. Thread 2 small (gold) open jump rings through the 2 large (yellow) jump rings at the end of the chain and then close them (**FIG. 2**).
3. Pass 1 large (orange) open jump ring between the 2 large (yellow) jump rings on the end of the chain so that it surrounds the 2 small (gold) jump rings without linking through them. Close the jump ring (**FIG. 3**).
4. Bring both ends of the chain together (**FIG. 4**).

Close the Flower

5. Reopen the 2 large (yellow) jump rings at the beginning of the chain as indicated in **FIG. 4** and slip them, 1 by 1, through the small (gold) closed jump rings at the end of the chain. Make sure the top large open jump ring passes over the top of the single closed large (orange) jump ring at the end of the chain and the other open jump ring passes underneath. Close the open jump rings (**FIG. 5**).

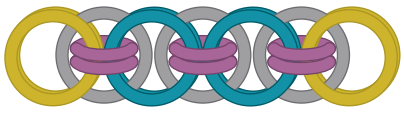


FIG. 1

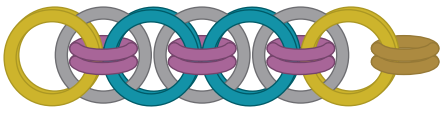


FIG. 2

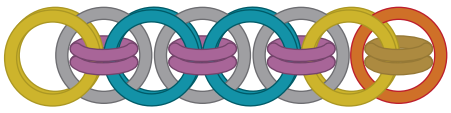


FIG. 3

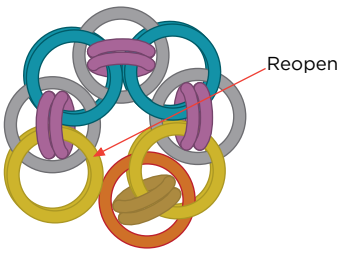


FIG. 4

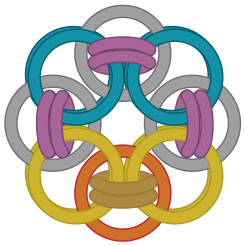


FIG. 5

TRY THIS:

Buds and Blooms

I call this sterling silver bracelet "Buds and Blooms." It's a mix of the two types of chain maille flower units covered in this book: the two-ring Flower Unit (page 43) that resembles a small rosebud and the Parallel Flower Unit, which is round and full as a flower in bloom. These two different units have a similar theme and blend together nicely, resulting in a cohesive design.

During the design process, I tried first making the basic Flower Units with 3 jump rings and then with 2 jump rings, all constructed using 16-gauge, 7.0 mm ID jump rings. I decided that I liked the weight and balance of the 2-jump-ring basic Flower Units better. I used 18-gauge, 3.5 mm ID jump rings to connect all the units together, echoing the size of the small jump rings used in the construction of each Parallel Flower Unit.

When creating your own designs, always consider details such as theme, size, weight, balance, and pattern. Make enough of each unit to reach the length you desire, connect them, and add a clasp for a fun, feminine floral accessory.

Parallel Twist Earrings

These half-moon-shaped earrings are a product of the happy accidents that often occur when you play with your supplies. For this design, I had a length of parallel chain out on the table, along with some miscellaneous items—jump rings, twisted-wire jump rings, and assorted findings—and I just began fiddling with all the pieces. Fast-forward about an hour and, voilà! These earrings emerged. You may want to add color to your earring design by mixing metals or embellishing them with beads. You could also join several of these shapes together to create interesting motifs for pendants or other decorative items.

SUPPLIES

28 sterling silver jump rings, 18g (AWG), 6.0 mm ID

34 sterling silver jump rings, 18g (AWG), 3.5 mm ID

2 sterling silver twisted-wire jump rings, 12g (AWG), 8.0 mm ID

1 pair of sterling silver ear wires

Make the Base Chain

1. Make 2 pieces of Parallel Chain, each using 14 large jump rings and 8 small jump rings, following the instructions for your favorite Parallel Chain method.

Prepare the Jump Rings

2. Open the remaining small jump rings and close the 2 twisted-wire jump rings.

Connect the Jump Rings

3. One at a time, thread 2 small jump rings through 1 twisted-wire jump ring and then through the 2 large jump rings at one end of the chain. Close the small jump rings.
4. Working toward the opposite end of the chain, thread 1 small jump ring through the next pair of large jump rings on the base chain and the twisted-wire jump ring. Repeat to connect the next 2 pairs of jump rings to the twisted-wire ring.
5. One at a time, thread 2 small jump rings through the twisted-wire jump ring and then through the remaining pair of large jump rings at the end of the chain. Close the small jump rings.
6. Repeat Steps 3–5 to make a second earring.

Attach the Ear Wires

7. Attach 1 small jump ring to the first pair of large jump rings on the earring. Then, thread 1 small open jump ring through the small jump ring just added to the earring and the ear wire, ensuring proper ear-wire orientation. Close the jump ring.
8. Repeat to attach the remaining ear wire to the second earring, being sure to change the earring's orientation to form a mirror image of the first earring.

TIP: **Another way to connect the Parallel Chain to the twisted jump ring is to add the small connecting jump rings to each pair of large jump rings on the Parallel Chain. Use the open twisted jump ring to scoop them up. To finish, just close the twisted jump ring.**

Round Maille Weaves

It is amazing how many different looks, such as the European 4-in-1, Byzantine, and Box Chain weaves, you can achieve by linking 4 jump rings through one. Round Maille is another 4-in-1 weave that makes a powerful design statement. Round Maille, as the name implies, is a round-chain weave—basically, a small three-sided tube. Its construction becomes apparent when you look at the weave from the end and notice that the jump rings are arranged in a triangular pattern. This is why Round Maille weaves are also known as triplicate weaves.

This chapter includes instructions for basic Round Maille and three of its variations: Turkish Round Maille, Inverted Round Maille, and Captive Inverted Round Maille. Beginners working with the recommended jump-ring sizes will produce thick round chains that make a strong visual impact.

With experience, Round Maille worked in small scale reveals amazingly delicate and intricate chain patterns. Add further interest by using jump rings in a linear progression of sizes for a bold necklace style that tapers gracefully around the back of the neck. Or graduate the jump rings in a repeating progression of sizes, producing an undulating chain weave. Highlight Turkish Round Maille by introducing jump rings of a different metal or color to the repeating elements in the pattern or mix the Round Maille weave variations into one piece of jewelry, as in the Caged Pearls Round Maille Bracelet (page 98).

Round Maille Weave

Round Maille is closely related to the European 4-in-1 weave; you can turn a flat sheet of European 4-in-1 chain maille into Round Maille just by joining it from side to side. However, I think it's easier to weave Round Maille as a straight chain. This traditional method of Round Maille construction is similar to the construction of the Box Chain (page 38). After you've learned to weave Round Maille as a chain, the Round Maille variations will be a piece of cake.

Jump-Ring Sizing

METAL	16-GAUGE		18-GAUGE	
	inner diameter	**rings per inch**	**inner diameter**	**rings per inch**
Sterling silver (AWG)	5.0 mm	45	3.5 mm	60
Aluminum (SWG)	7/32"	39	3/16" (moves better) or 5/32" (looks better*)	42 or 45

***Because the range of sizes available for aluminum jump rings is not as broad as the wide range of jump-ring sizes available in silver, it is sometimes difficult to achieve a perfect aspect ratio for all aluminum gauges. However, aluminum is inexpensive, so you can try out both sizes and decide which is best for your intended purpose.**

note: *All Round Maille weaves begin the same way: A starter chain is joined into a 3-sided triangular base. The shape makes this weave a bit tricky to hold onto and also a bit confusing to look at. It's a good idea to use a starting aid, and I usually attach 3 paperclips, one to each adjacent pair of jump rings at the end of the starter chain. The first is connected to jump rings 1 and 2, a second is connected to jump rings 2 and 3, and a third is connected to jump rings 3 and 1, as shown in figs. 3 and 4.*

Prepare Jump Rings

1. Close 6 jump rings (to be used in starter chain) and open the rest.

Start the Weave

2. Make a 2-1-2-1-2 chain following the instructions on page 26 (**FIG. 1**).
3. Thread 1 open jump ring through the ends of the starter chain to form a closed triangle shape (**FIG. 2**).
4. Arrange the top 3 (orange) jump rings and the bottom 3 (blue) jump rings as shown in figure 3. Attach the starting aids (**FIG. 4**).
5. Hold the base at the 3 center (white) jump rings and let the 3 top (orange) jump rings flop out to the sides (**FIG. 5**). Then fold back the jump rings toward the beginning of the chain.
6. Spread open the 3 (white) jump rings that are now on top, revealing the inner triangle of folded (orange) jump rings, as marked 1, 2, and 3 in **FIG. 6**.
7. Connect 3 (yellow) jump rings to the inner triangle jump rings as follows:

   Thread and close 1 open jump ring through inner jump rings 1 and 2.

   Thread and close 1 open jump ring through inner jump rings 2 and 3.

   Thread and close 1 open jump ring through inner jump rings 3 and 1 (**FIG. 7**).

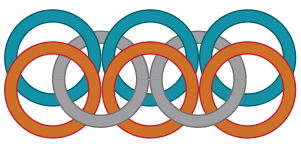


FIG. 1

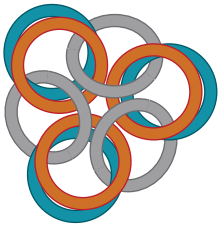


FIG. 2

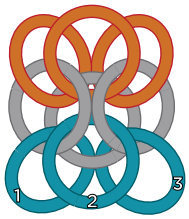


FIG. 3

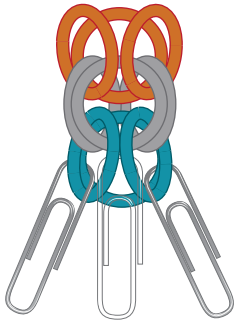


FIG. 4

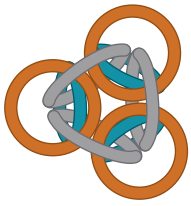


FIG. 5

FIG. 6

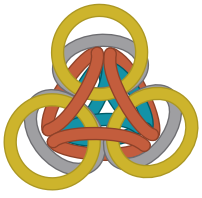


FIG. 7

Weave the Pattern

8. Link 3

   Connect 3 open (purple) jump rings to the 3 (yellow) jump rings at the top of the chain as follows (**FIG. 8**):

   Thread and close 1 open jump ring through jump rings 1 and 2.

   Thread and close 1 open jump ring through jump rings 2 and 3.

   Thread and close 1 open jump ring through jump rings 3 and 1.

9. Fold Back and Spread

   Hold the chain below the 3 (purple) jump rings just added and let them flop out to the sides (**FIG. 9**). Then fold back the jump rings toward the beginning of the chain.

   Spread open the 3 (yellow) jump rings that are now on top, revealing the inner triangle of folded (purple) jump rings (**FIG. 10**).

10. Fill the Spread (Inner Triangle)

    Thread 3 open (green) jump rings through the 3 inner triangle (purple) jump rings as follows (**FIG. 11**):

    Thread and close 1 open jump ring through inner jump rings 1 and 2.

    Thread and close 1 open jump ring through inner jump rings 2 and 3.

    Thread and close 1 open jump ring through inner jump rings 3 and 1.

11. Repeat Steps 8–10 until the weave reaches the desired length.

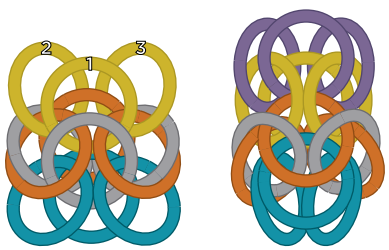


FIG. 8

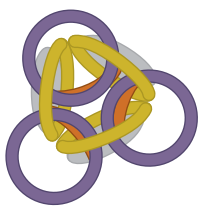


FIG. 9

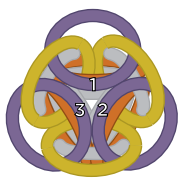


FIG. 10

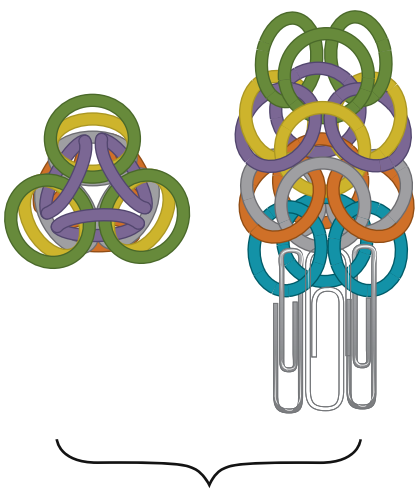


FIG. 11

Turkish Round Maille Weave

This complex-looking pattern always attracts attention. The technique for constructing Turkish Round Maille is almost identical to the technique for constructing Round Maille; however, the chains produced have a different appearance. Round Maille has a tight, smooth, and even texture, and Turkish Round Maille is more open and intricate.

Jump-Ring Sizing

METAL	16-GAUGE		18-GAUGE	
	inner diameter	**rings per inch**	**inner diameter**	**rings per inch**
Sterling silver (AWG)	4.5 mm	36	3.5 mm	45
Aluminum (SWG)	7/32"	33	5/32"	36

COMPARE AND CONTRAST

To help you understand this weave, it is helpful to make the following comparisons: Turkish Round Maille (such as Byzantine) requires you to add 3 sets of jump rings before performing the folding step. Round Maille (such as Box Chain) requires you to add 2 sets of jump rings before performing the folding step.

Prepare Jump Rings

1. Close 6 jump rings (to be used in starter chain) and open the rest.

Start the Weave

2. Begin the weave by following Steps 2–7 of the traditional Round Maille technique, page 91.

Weave the Pattern

Turkish Round Maille follows the same basic technique as Round Maille, adding 9 jump rings (instead of 6) before the folding step.

3. Link 3 (Twice)

   Connect 3 open (purple) jump rings to the 3 (yellow) jump rings at the top of the chain as follows (**FIG. 1**):

   Thread and close 1 open jump ring through jump rings 1 and 2.

   Thread and close 1 open jump ring through jump rings 2 and 3.

   Thread and close 1 open jump ring through jump rings 3 and 1.

   Repeat to connect 3 open (green) jump rings to the 3 (purple) jump rings just added at the top of the chain (**FIG. 2**).

4. Fold Back and Spread

   Hold the chain below the 3 (green) jump rings just added (**FIG. 2**) and let them flop out to the sides (**FIG. 3**). Then fold back the jump rings toward the beginning of the chain.

   Spread open the 3 (purple) jump rings that are now on top, revealing the inner triangle of folded (green) jump rings (**FIG. 4**).

5. Fill the Spread (Inner Triangle)

   Thread 3 open (orange) jump rings through the 3 inner triangle (green) jump rings as follows (marked in **FIG. 4**):

   Thread and close 1 open jump ring through inner jump rings 1 and 2.

   Thread and close 1 open jump ring through inner jump rings 2 and 3.

   Thread and close 1 open jump ring through inner jump rings 3 and 1 (**FIG. 5**).

6. Repeat Steps 3–5 until the weave reaches the desired length.

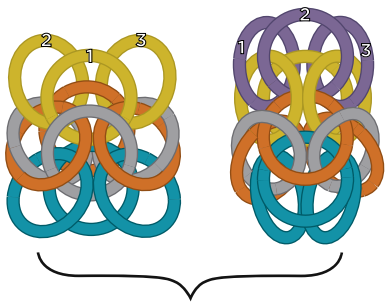


FIG. 1

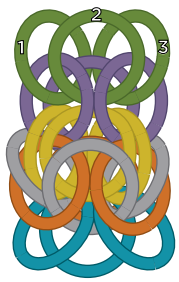


FIG. 2

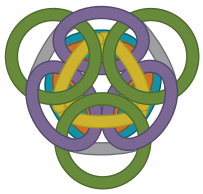


FIG. 3

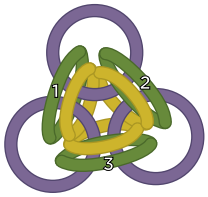


FIG. 4

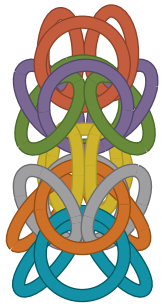


FIG. 5

Inverted Round Maille Weave

The technique for constructing Inverted Round Maille is similar to the technique for constructing Round Maille and Turkish Round Maille. The only difference in creating this weave is that you never fold back and spread the jump rings, hence the inverted appearance.

There is not a lot of wiggle room when it comes to the aspect ratio for this weave. A little on the tight side and the chain will be stiff—useful for constructing sculptural objects. A little on the loose side, however, and the chain can look a bit sunken and sloppy. To make a lovely flexible chain, I'm partial to the 18-gauge sterling silver jump rings recommended in the Jump-Ring Sizing chart.

Jump-Ring Sizing

METAL	16-GAUGE		18-GAUGE	
	inner diameter	**rings per inch**	**inner diameter**	**rings per inch**
Sterling silver (AWG)	5.5 mm or 5.25 mm*	18 or 21	4.25 mm	24
Aluminum (SWG)	¼"	18	3⁄16"	21

***The 5.25 mm rings I tested would be too tight for the sharp curves of a bracelet but would work for a neck chain. Test the rings from your favorite vendor to determine what size is appropriate for your project.**

Prepare Jump Rings

1. Close 6 jump rings (to be used in starter chain) and open the rest.

Start the Weave

2. Make a 2-1-2-1-2 chain following the instructions on page 26 (**FIG. 1**).
3. Thread 1 open jump ring through the ends of the starter chain to form a closed triangle shape (**FIG. 2**).
4. Arrange the top 3 (orange) jump rings and the bottom 3 (blue) jump rings as shown in **FIG. 3**. Attach the starting aids (note, Round Maille, page 90).

Weave the Pattern

5. Link 3

   Connect 3 open (green) jump rings to the 3 (orange) jump rings at the top of the chain as follows (**FIG. 4**):

   Thread and close 1 open jump ring through jump rings 1 and 2.

   Thread and close 1 open jump ring through jump rings 2 and 3.

   Thread and close 1 open jump ring through jump rings 3 and 1.
6. Repeat Step 5 until the chain reaches the desired length.

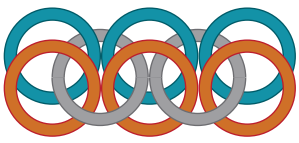


FIG. 1

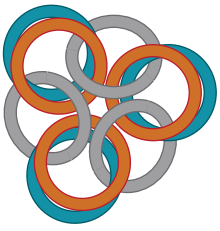


FIG. 2

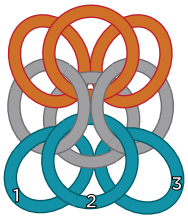


FIG. 3

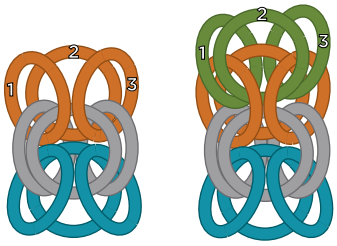


FIG.4

TRY THIS:

Captive Inverted Round Maille Weave

Traditionally, the captive elements in this chain are more jump rings. Here you'll add some color and sparkle by capturing crystals or beads in the center of the weave.

Jump-Ring Sizing

METAL	18-GAUGE	
	inner diameter	**rings per inch**
Sterling silver (AWG)	5.5 mm	18
Aluminum (SWG)	7/32"	18

ADDITIONAL SUPPLIES

3 round 6 mm beads per 1" (2.5 cm) of weave.

To construct Captive Inverted Round Maille, follow the instructions for Inverted Round Maille (page 95), substituting the jump ring sizes with those in the chart (a larger aspect ratio is needed to accommodate captive elements). The weave is exactly the same. After completing Step 4, insert a bead into the center of the chain (**FIG. 1**). Add the next 6 jump rings in the weave (2 rows of 3 jump rings), and then insert another bead. Continue in this manner, inserting a bead after adding 6 jump rings, until the chain reaches the desired length.

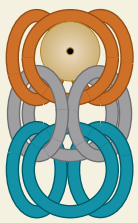


FIG. 1

TIP: As soon as you place your bead and then attempt to add the next jump ring, the bead will most likely fall out! Don't get frustrated. Try one of these strategies or come up with your own.

Add the first 2 jump rings of the next row and then place the bead before you complete the row with the third jump ring.

Weave ahead 1 complete row of 3 jump rings. Then add the bead and gently press it down into the proper position in the weave.

Caged Pearls Round Maille Bracelet

When I teach the Round Maille weaves, invariably someone messes up on the folds and makes a combination weave. They often become frustrated because they think they've done something wrong. I made this bracelet to prove that such mistakes can be quite beautiful. This weave is a hybrid of Round Maille and Captive Inverted Round Maille. I used pearl beads in the cages, but you could add more color or sparkle with crystals or multicolored beads.

SUPPLIES

216 sterling silver jump rings, 18g (AWG), 3.5 mm ID

30 sterling silver jump rings, 18g (AWG), 5.5 mm ID

8 sterling silver jump rings (for clasp), 18g (AWG), 3.5 mm ID

5 Swarovski pearl round beads, 6 mm

1 sterling silver toggle clasp, 10.5 mm

FINISHED LENGTH

6¼" (16 cm) not including clasp

To adjust the length of the bracelet, add or subtract jump rings in each Round Maille section (multiples of 6) or add/subtract caged pearl and Round Maille sections.

Start the Pattern

1. Make a segment of Round Maille using 39 of the 3.5 mm jump rings, following the instructions on page 90.

Weave the Pattern

2. Weave 2 rows of Inverted Round Maille, adding 6 of the 5.5 mm jump rings to the end of the Round Maille segment just completed. Begin the Inverted Round Maille by adding jump rings to the inner triangle jump rings of the segment and follow the instructions on page 96.
3. Place a pearl bead in the cage of Inverted Round Maille just completed.
4. Weave a segment of Round Maille, adding 36 of the 3.5 mm jump rings to the top of the cage just completed.
5. Repeat Steps 2–4 four more times, 5 caged pearls and 6 Round Maille sections completed.

Finish

6. Complete the finishing end of the bracelet using 2 of the 3.5 mm jump rings to attach the loop of the toggle clasp, following the instructions for the Round Maille finishing Method B on page 133 (**FIG. 1**).
7. Complete the starting end of the bracelet by removing the first three 3.5 mm jump rings of the chain and use them to make a 1-1-1 chain (page 24).
8. Use one 3.5 mm jump ring to attach the 1-1-1 chain to the bar of the toggle clasp.
9. Using the last 2 jump rings (3.5 mm), attach the 1-1-1 chain connected to the bar of the toggle clasp to the starting end of the bracelet following the instructions for the Round Maille finishing Method B (**FIG. 2**).

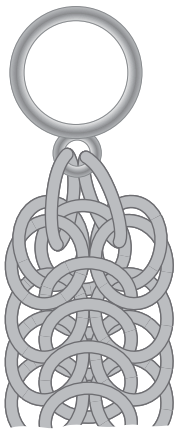


FIG. 1

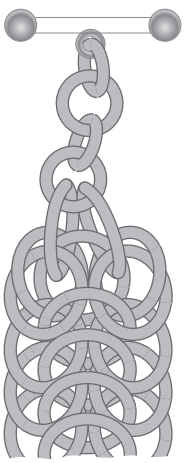


FIG. 2

Persian Weaves

The name for this family of weaves, the Persian Weaves, conjures up romantic images of ancient cultures and exotic places. In reality, however, the name simply refers to the weave's style as its true origins have not been determined. The Persian weaves involve intricate linkage patterns that produce chains with depth, weight, and complexity.

A distinguishing characteristic of Persian weaves is the type of connections used to produce them. So far, all the chains we've constructed in this book have used only simple jump-ring–to–jump-ring connections or Through the Eye (TE) connections. In Persian weaves, however, the jump rings are added using both Around the Eye (AE) and Through the Eye (TE) connections (page 22). These weaves, especially the Half-Persians (page 106 and 109), are difficult to begin, and there are a number of methods, tools, and tricks people use to start the weaves. I developed an easy-to-make starter tool, and a template and instructions for making that tool are included on page 105.

The construction of these chains is a bit more complex than the previous weaves, but they are worth the extra effort, as the Reversible Double Half-Persian 4-in-1 Collar shows (page 116)!

Full Persian Weave

Full Persian is a 6-in-1 weave that produces a thick, round, and substantial-looking chain also known as Foxtail, a name that aptly describes the weave's bushy appearance. I love the way this pattern looks when woven in small scale: exceedingly dense and intricate. As with Round Maille, this round chain looks stunning when constructed using graduated sizes of jump rings.

The jump rings in the weave produce a series of nested Vs along the length of the chain. Notice how the Vs run in one direction on the north and south sides of the chain and in the opposite direction on the east and west sides of the chain. Try highlighting this feature using jump rings in different colors, metals, or textures.

Jump-Ring Sizing

METAL	16-GAUGE		18-GAUGE	
	inner diameter	**rings per inch**	**inner diameter**	**rings per inch**
Sterling silver (AWG)	7.5 mm	20	6.0 mm	24
Aluminum (SWG)	3/8″ (moves better) or 5/16″ (looks better*)	12 or 16	1/4″	20

***Because the range of sizes available for aluminum jump rings is not as broad as the wide range of jump-ring sizes available in silver, it is sometimes difficult to achieve a perfect aspect ratio for all aluminum gauges. However, aluminum is inexpensive, so you can try out both sizes and decide which is best for your intended purpose.**

note: *I recommend beginning this chain on a starting aid.*

Prepare Jump Rings

1. Close 2 jump rings (to be used in starter chain) and open the rest.

Start the Weave

2. Make a 2-2 chain following the instructions on page 22 (**FIG. 1**) and attach a starting aid to the first 2 jump rings on the chain.
3. Hold the chain at the first 2 (blue) jump rings and let the top 2 (yellow) jump rings flop out to the sides (**FIG. 2**). Then fold back the jump rings toward the beginning of the chain (**FIG. 3**).
4. Spread open the 2 (blue) jump rings that are now on top, revealing the inner folded (yellow) jump rings (**FIG. 4**).
5. Working between the spread (blue) jump rings, thread and close 1 open (orange) jump ring straight through the inner (yellow) jump rings. Then thread and close another open jump ring straight through the inner (yellow) jump rings (**FIG. 5**).

   Follow Step 6 of either Method A or B.

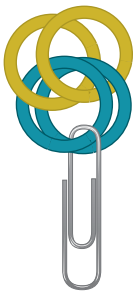


FIG. 1

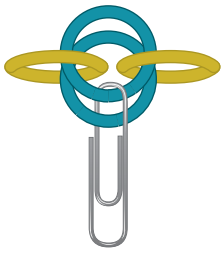


FIG. 2

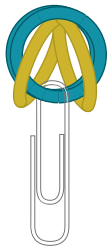


FIG. 3

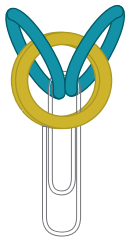


FIG. 4

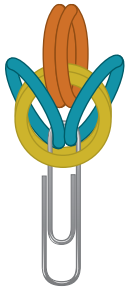


FIG. 5

Weave the Pattern

The next pair of jump rings can be woven into position from the top down (Method A) or from the bottom up (Method B). Try both methods and choose the angle that is most comfortable for you.

Method A

6. Link Back (Twice)

Thread 1 open (white) jump ring through the top 2 (orange) jump rings, but do not close it (**FIG. 6**).

Tip the open (white) jump ring down and thread it through the (blue) jump rings in the previous row, as marked in figure 6. These (blue) jump rings form a V shape that points back to the starting end of the chain.

Close the open (white) jump ring (**FIG. 7**).

Repeat to add a second jump ring on the opposite side of the chain. Now the orange jump rings are on top.

Method B

6. Link Back (Twice)

Thread 1 open (white) jump ring through the (blue) jump rings in the previous row but do not close it. These (blue) jump rings form a V shape that points back to the starting end of the chain.

Thread the open (white) jump ring through the 2 (orange) jump rings on the top of the chain (**FIG 8**).

Close the open (white) jump ring (**FIG. 7**).

Repeat to add a second jump ring on the opposite side of the chain. Now the orange jump rings are on top.

All Methods

7. Spread and Add 2:

Spread the top 2 (orange) jump rings (**FIG. 9**).

Thread and close 1 open (green) jump ring straight through the inner (white) jump rings. Then thread and close another open jump ring straight through the inner jump rings (**FIG. 10**).

8. Repeat Steps 6 and 7 until the weave reaches the desired length.

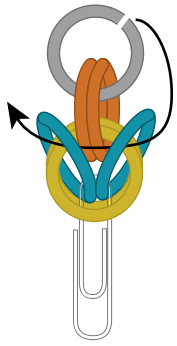


FIG. 6

METHOD A

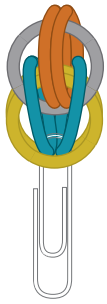


FIG. 7

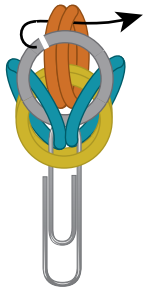


FIG. 8

METHOD B

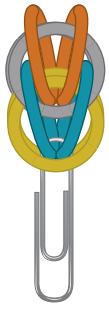


FIG. 9

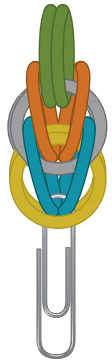


FIG. 10

Half-Persian Starter Tool

The Half-Persian weaves (page 106 and 109) are extremely difficult weaves to begin. I created this tool to help me get these weaves started. It is simple to make, and it really works.

When I first began to learn chain maille, I was desperate to learn the Half-Persian 4-in-1 Weave. But I struggled with keeping the weave stable enough to add the jump rings according to the pattern. One popular solution is to use a starter piece, but you need to know how to make the weave to make the starter piece.

I tried masking tape, as it works well with European 4-in-1, but not with Half-Persian. Online, I found other tips for stabilizing the jump rings, none of which worked for me. Then I thought about devising a stable object that I could attach the jump rings to. I first tried a playing card—it ripped. Then I tried a strip of leather, better but a bit thick. Soon after, I was introduced in a jewelry class to a urethane film called Tuff Brake. When I saw how strong, flexible, and thin the film was, I knew I had found it—the perfect material with which to start my half-Persian weave. Best of all, no starter piece necessary!

FIG. 1

SUPPLIES

1 piece of Tuff Brake, at least 1½ x 3½" (3.8 x 9 cm)

1/16" (2 mm) hole punch

Construction

1. Enlarge **FIG. 1** to measure about 1½ x 3½" (3.8 x 9 cm).
2. Using **FIG. 1** as a template, trace the lines and mark the dots on the piece of Tuff Brake. Cut the Tuff Brake along the traced lines using scissors.
3. Using the dots traced on the Tuff Brake as a guide, punch four holes in each of three corners using the 1/16" (2 mm) hole punch. The widest-spaced holes are for large jump rings, the medium-spaced holes are for medium-sized jump rings, and the closely spaced holes are for small jump rings (**FIG 2**).

   If you cannot find Tuff Brake, use a small swatch of single crochet (**FIG. 3**) to start the half-Persian weaves. The holes in crocheted fabric are perfect for holding the jump rings in place. For this swatch, I used size 10 crochet cotton thread and a size 7 steel crochet hook. The swatch I made measures 4½ x 2" (11.5 x 5 cm).

FIG. 2

FIG. 3

Half-Persian 4-in-1 Chain

This is one of my favorite weaves because its flat profile seems to float over the skin—perfect for bracelets and collars. Each jump ring added is woven into 4 jump rings on the chain, hence the name 4-in-1. It looks fairly simple to create but the pattern can be a bit complicated to understand. Each jump ring added requires you to use a combination of TE and AE connections to put it into the proper position. When I teach the Half-Persian weaves, I always begin with Half-Persian 4-in-1; after you've learned it, Half-Persian 3-in-1 is a snap.

Jump-Ring Sizing

METAL	16-GAUGE		18-GAUGE	
	inner diameter	**rings per inch**	**inner diameter**	**rings per inch**
Sterling silver (AWG)	7.5 mm	14	6.0 mm	16
Aluminum (SWG)	5/16"	12	1/4"	14

ADDITIONAL SUPPLIES

Half-Persian starter tool (page 105)

note: *Left-handed people should work in the opposite direction of the written instructions.*

Prepare

Start with an even number of jump rings.

1. Open half of the jump rings and set aside. These are the linking jump rings (see Link Up, page 111).
2. Open 4 of the remaining jump rings and close the rest. Set aside in a separate pile. These are the *base-row* jump rings (see Link Up).
3. Choose the corner of the tool that will best fit the size jump rings you want to use. Attach the 4 open *base-row* jump rings to the tool and then close them (**FIG. 1**). These are the 4 starter jump rings (first 4 jump rings of the base row).

note: *The inner jump ring must lie on top of the other 3. Maintain this orientation throughout; the weave is direction dependent.*

Start the Weave

4. Thread 1 open (green) jump ring through starter jump rings 4 and 3, moving right to left from behind the starter tool. Then thread the jump ring through starter jump rings 1 and 2, moving left to right from the front of the starter tool, as marked in figure 1. You will use a TE connection between jump rings 4 and 3, an AE connection between jump rings 2 and 3, and a TE connection between jump rings 1 and 2 (page 22).
5. Close the open jump ring. This is the first linking jump ring (**FIG. 2**).

Weave the Pattern

6. Thread 1 open (white) jump ring through 1 closed (purple) jump ring (**FIG. 3**).
7. Thread the open jump ring through starter jump ring 4, moving right to left from behind the starter tool, and then through starter jump rings 2 and then 3, moving left to right from the front (**FIG. 4**).
8. Close the open (white) jump ring. It should lie in front of the first linking (green) jump ring, 1 base-row jump ring added (**FIG. 5**, jump ring 5).
9. Thread 1 open (blue) jump ring through 1 closed (yellow) jump ring (**FIG. 6**).

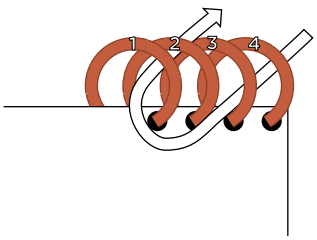


FIG. 1

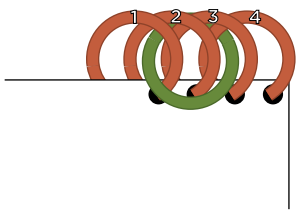


FIG. 2

FIG. 3

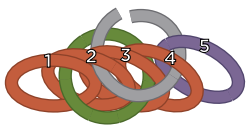


FIG. 4

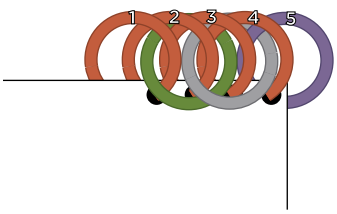


FIG. 5

FIG. 6

10. Thread the open jump ring through the base-row jump ring added at the end of the chain, moving right to left from behind, and then through the 2 adjacent base-row jump rings (starter jump rings 3 and 4), moving left to right from the front.

11. Close the open (blue) jump ring. It should lie in front of the previous linking (white) jump ring, 1 base-row jump ring added (**FIG. 7**, jump ring 6).

12. Continue to add linking and base-row jump rings in this manner until the chain reaches the desired length. You should end up with 3 open linking jump rings left over.

Finish (to even ends)

13. Open starter jump ring 1 and remove it from the tool and the chain. Close it and set aside.

14. Thread 1 of the remaining open (light blue) jump rings through the (orange) jump ring just removed from the tool.

15. Thread the open jump ring through the base-row (yellow) jump ring at the finishing end of the chain, moving right to left from behind it. Then thread the open jump ring through the 2 adjacent base-row (orange/purple) jump rings, moving left to right from the front. Close the open jump ring (**FIG. 8**).

16. Thread 1 of the remaining 2 open (pink) jump rings through the base-row (orange) jump ring just added, moving right to left from behind it. Then thread the open jump ring through the 2 adjacent base-row (purple/yellow) jump rings, moving left to right from the front. Close the open jump ring (**FIG 9**).

17. Thread the remaining open (blue) jump ring through the last 2 adjacent base-row (yellow/orange) jump rings, moving left to right from the front. Close the open jump ring (**FIG 10**).

18. One at a time, slightly open starter jump rings 2, 3, and 4 and gently slip them off the tool, while preserving their position in the weave, and close them.

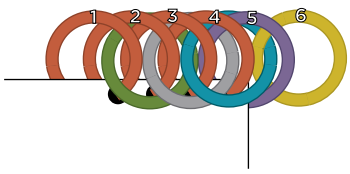


FIG. 7

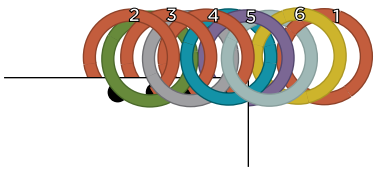


FIG. 8

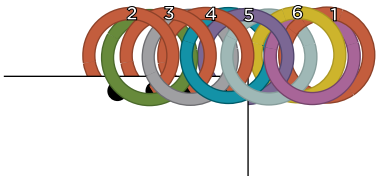


FIG. 9

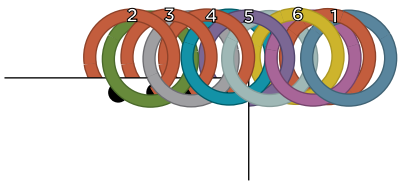


FIG. 10

Half-Persian 3-in-1 Chain

As the name suggests, the Half-Persian 3-in-1 technique produces a less dense weave: Each new jump ring threads through only 3 jump rings at a time. Imagine cutting a Full Persian chain in half lengthwise. This chain has distinct sides; the front appears convex and the back concave, which makes this weave a great choice for creating a chain maille bezel (a band of metal holding a gemstone in its setting) to transform a cabochon into a pendant. In addition, Half-Persian 3-in-1 is often used to create decorative edgings in chain maille.

This weave is just as tricky to begin as the Half-Persian 4-in-1, so you will use the Half-Persian Starter Tool to begin this weave by inserting jump rings in only 3 of the 4 holes.

Jump-Ring Sizing

METAL	16-GAUGE		18-GAUGE	
	inner diameter	**rings per inch**	**inner diameter**	**rings per inch**
Sterling silver (AWG)	6.0 mm	12	4.5 mm	14
Aluminum (SWG)	¼″	10	3⁄16″ or 7⁄32″	14 or 12

ADDITIONAL SUPPLIES

Half-Persian starter tool (page 105)

note: *Left-handed people should work in the opposite direction of the written instructions.*

Prepare

Start with an even number of jump rings.

1. Open half of the jump rings and set aside. These are the linking jump rings (see Link Up, page 111).
2. Open 3 of the remaining jump rings and close the rest. Set aside in a separate pile. These are the *base-row* jump rings (see Link Up).
3. Choose the corner of the tool that will best fit the size jump rings you want to use. Attach the 3 open base-row jump rings to the tool, leaving the innermost hole empty, and then close them (**FIG. 1**). These are the 3 starter jump rings (first 3 jump rings of the base row).

note: *The inner jump ring must lie on top of the other 2. Maintain this orientation throughout; the weave is direction dependent.*

Start the Weave

4. Thread 1 open (green) jump ring through starter jump rings 3 and 2, moving right to left from behind the starter tool. Then thread the jump ring through starter jump ring 1, moving left to right from the front of the starter tool, as marked in **FIG. 2**. You will use a TE connection between jump rings 3 and 2, and an AE connection between jump rings 2 and 1 (page 22).
5. Close the open jump ring. This is the first linking jump ring (**FIG. 3**).

Weave the Pattern

6. Thread 1 open (white) jump ring through 1 closed (purple) jump ring (**FIG. 4**).
7. Thread the open jump ring through starter jump ring 3, moving right to left from behind the starter tool, and then through starter jump ring 2, moving left to right from the front.
8. Close the open (white) jump ring. It should lie in front of the first linking (green) jump ring, 1 base-row jump ring added (**FIG. 5**, jump ring 4).
9. Thread 1 open (blue) jump ring through 1 closed (yellow) jump ring (**FIG. 6**).

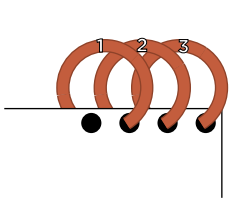


FIG. 1

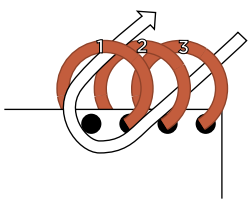


FIG. 2

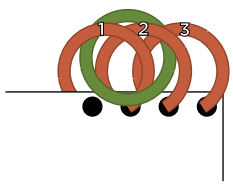


FIG. 3

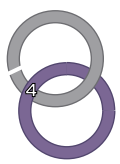


FIG. 4

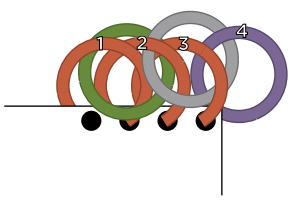


FIG. 5

FIG. 6

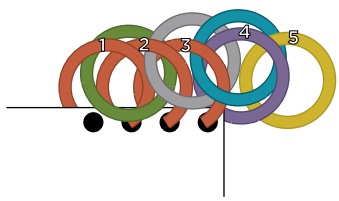


FIG. 7

10. Thread the open jump ring through the base-row jump ring added at the end of the chain, moving right to left from behind, and then through the adjacent base-row jump ring (starter jump ring 3), moving left to right from the front.

11. Close the open (blue) jump ring. It should lie in front of the previous linking (white) jump ring, 1 base-row jump added (**FIG. 7**, jump ring 5).

12. Continue to add linking and base-row jump rings in this manner until the chain reaches the desired length. You should end up with 2 open jump rings (linking jump rings) left over.

Finish (to even ends)

13. Open starter jump ring 1 and remove it from the tool and the chain. Close it and set aside.

14. Thread 1 of the remaining open (light blue) jump rings through the (orange) jump ring just removed from the tool.

15. Thread the open jump ring through the base-row (yellow) jump ring at the finishing end of the chain, moving right to left from behind it. Then thread the open jump ring through the adjacent base-row (purple) jump ring, moving left to right from the front. Close the open jump ring (**FIG. 8**).

16. Thread the remaining open (white) jump ring through the base-row (orange) jump ring just added, moving right to left from behind it. Then thread the open jump ring through the adjacent base-row (yellow) jump ring, moving left to right from the front. Close the open jump ring (**FIG. 9**).

17. One at a time, slightly open starter jump rings 2 and 3 and gently slip them off the tool, while preserving their position in the weave, and close them.

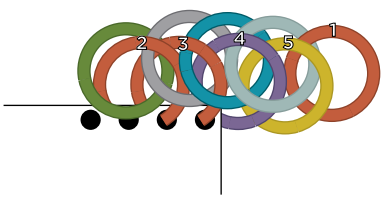


FIG. 8

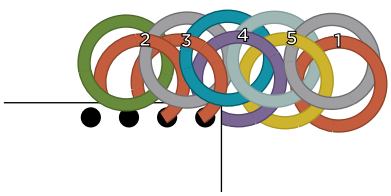


FIG. 9

LINK UP

When weaving half-Persian weaves, the jump rings have one of two functions: base-row jump rings or linking jump rings. The jump rings you attach to the Half-Persian Starter Tool and all pre-closed jump rings are the base-row jump rings. (They make up the base row of the weave.) These jump rings are passive, meaning you weave into them, but you do not use them to weave into other jump rings.

The open jump rings are the active linking jump rings. You weave them into the base-row jump rings to construct the weave. Linking jump rings are only woven into base-row jump rings, not other linking jump rings.

An easy way to learn these weaves is to use jump rings of different colors—one color for the base-row jump rings and another for the linking jump rings. Inexpensive anodized aluminum jump rings come in a variety of colors and are found through most chain maille supply vendors.

Half-Persian 3-in-1 Sheet

When you have learned how to create a Half-Persian 3-in-1 Chain, you are ready to weave it into a larger sheet, perfect for cuff-style bracelets, chokers, and collars. One easy way to transform a Half-Persian 3-in-1 Chain into a sheet is to build one row of half-Persian chain on top of another. (This method is technically known as Half-Persian 3-in-1 Sheet 5, because as you add one row to another you form 5-in-1 connections. There's also Half-Persian 3-in-1 Sheet 6, but let's keep things simple.) Just continue adding rows to make the sheet as wide as you like.

Jump-Ring Sizing

METAL	16-GAUGE		18-GAUGE	
	inner diameter	**rings per inch**	**inner diameter**	**rings per inch**
Sterling silver (AWG)	7.5 mm	30*	6.0 mm	36*
Aluminum (SWG)	5/16"	24*	1/4"	30*

***Number of jump rings needed to weave 3 rows per 1 inch.**

ADDITIONAL SUPPLIES

Half-Persian starter tool (page 105)

notes: *Weaving a sheet of Half-Persian 3-in-1 will require some extra steps to keep the rows even at both ends. When you are finished, you will remove the first and last jump ring of each row. Keep this in mind when you are making your base chain to ensure that you make it the correct length.*

Left-handed people should work in the opposite direction of the written instructions.

Prepare

1. Open and close jump rings for the base chain per Half-Persian 3-in-1, page 110. Open all the jump rings needed to construct the subsequent rows.

Start the Weave

2. Make a base chain of Half-Persian 3-in-1 (through Step 12) to the desired length. Do not remove from the tool (**FIG. 1**).

3. Even the end of the base chain by adding 2 additional linking jump rings as follows:

   Thread an open (orange) jump ring through the base-row jump ring at the finishing end of the chain (jump ring 8), moving right to left from behind it. Then thread the open jump ring through the adjacent base-row jump ring (jump ring 7), moving left to right from the front. Close the open jump ring (**FIG. 2**).

   Thread an open (blue) jump ring through the last base-row jump ring on the base chain (jump ring 8), moving left to right from the front. Close the open jump ring (**FIG. 3**).

note: *When Step 3 is complete you should have the same number of base-row jump rings and linking jump rings on your base chain.*

Weave the Pattern

Adding subsequent rows of Half-Persian 3-in-1 to the base chain is a two-step process. First you will add a row of base-row rings through the linking rings along the length of the base chain (similar to adding a row to widen a sheet of European 4-in-1, page 63). Then, linking rings are woven into the row of base-row jump rings just added to complete the row of Half-Persian 3-in-1.

4. Add Base-Row Jump Rings

   Thread 1 open (orange) jump ring through the first linking (blue) jump ring on the base chain from the front (**FIG. 4**).

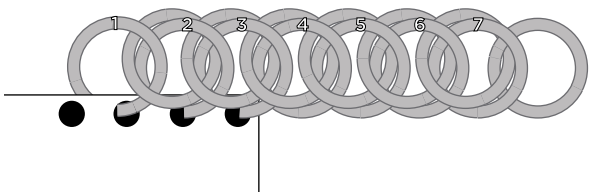


FIG. 1

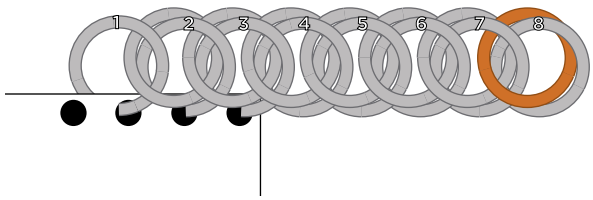


FIG. 2

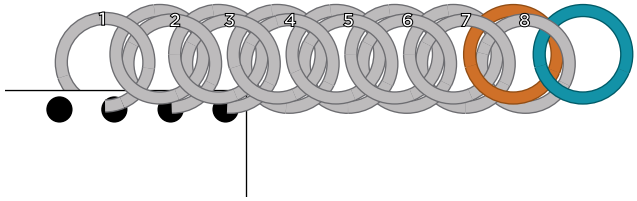


FIG. 3

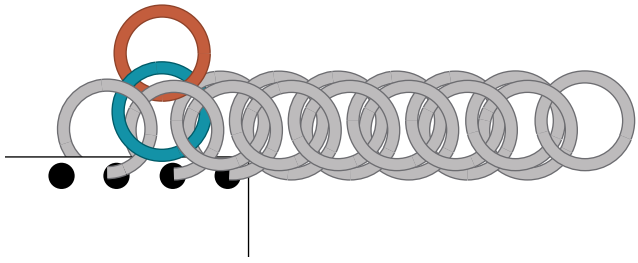


FIG. 4

5. Thread 1 open (orange) jump ring through the second and first linking (blue/yellow) jump rings on the base chain from the front using a TE connection (page 22) (**FIG. 5**). Close the jump ring.

6. Thread 1 open (orange) jump ring through the third and second linking (blue/yellow) jump rings on the base chain from the front using a TE connection (**FIG. 6**). Close the jump ring.

7. Continue in this manner to thread open jump rings through adjacent pairs of linking rings along the length of the base chain to complete the row (**FIG. 7**).

note: *When Step 7 is complete the number of base-row jump rings just added should match the number of base-row jump rings on the base chain.*

8. Add Linking Jump Rings

   Thread 1 open (orange) jump ring through base-row (green/yellow) jump rings 3 and 2, moving right to left from behind the starter tool. Then thread the jump ring through base-row (blue) jump ring 1, moving left to right from the front of the starter tool. You will use a TE connection between jump rings 3 and 2 and an AE connection between jump rings 2 and 1 (page 22). Close the open jump ring (**FIG. 8**).

9. Repeat Step 8 along the length of the chain, moving over 1 base-row jump ring to the right. (**FIGS. 9 AND 10**).

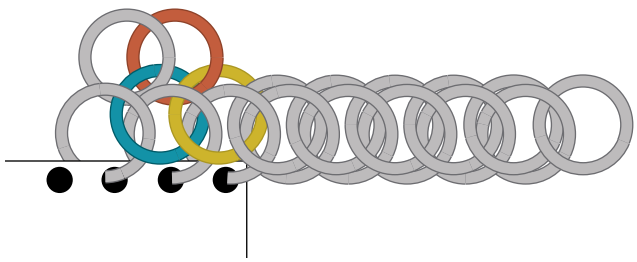


FIG. 5

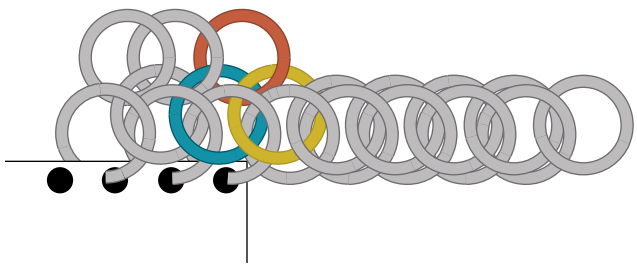


FIG. 6

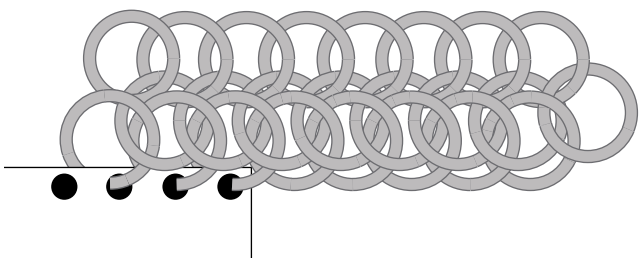


FIG. 7

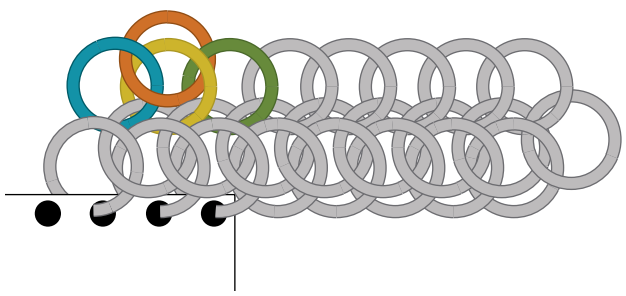


FIG. 8

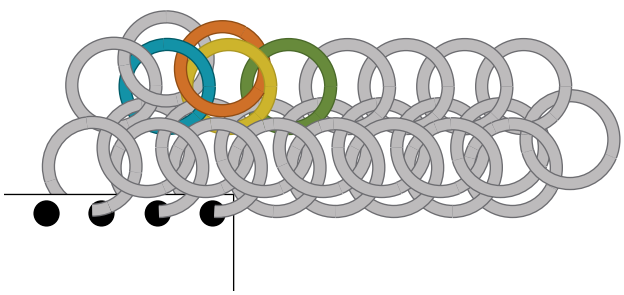


FIG. 9

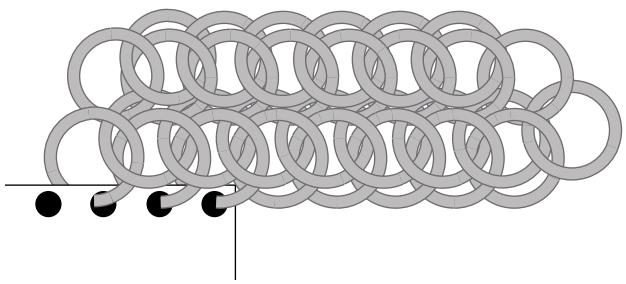


FIG. 10

10. Even the end of the row:

Thread 1 open (orange) jump ring through the last base-row (yellow) jump ring, moving right to left from behind the starter tool. Then thread the jump ring through the adjacent base-row (blue) jump ring, moving left to right from the front of the starter tool (**FIG. 11**).

Thread an open (orange) jump ring through the last base-row (yellow) jump ring, moving left to right from the front. Close the open jump ring (**FIG. 12**).

note: *When Step 10 is complete you should have the same number of base-row jump rings and linking jump rings on the row just completed.*

11. Repeat Steps 4 through 10 once more to make a 3-row sheet (**FIG. 13**).

note: *You can make a wider sheet by following Steps 4 through 10 to create additional rows. You can also stop at Step 10 to make a double-row chain.*

Finish

12. Remove the piece from the tool: one at a time, slightly open the starter jump rings and gently slip them off the tool, preserving their position in the weave, and close them.

13. Remove the single jump rings on the edges of the weave (as shown in **FIG. 13**) to even the weave (**FIG. 14**).

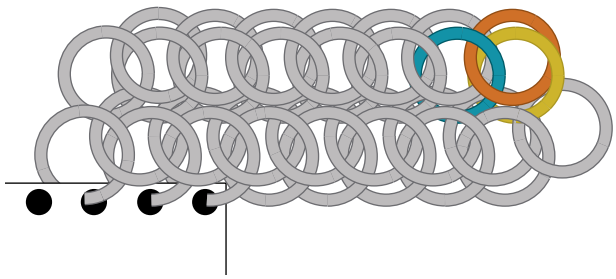


FIG. 11

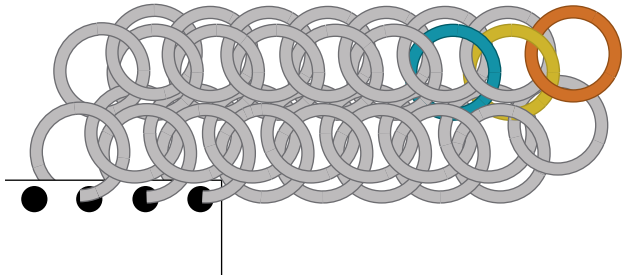


FIG. 12

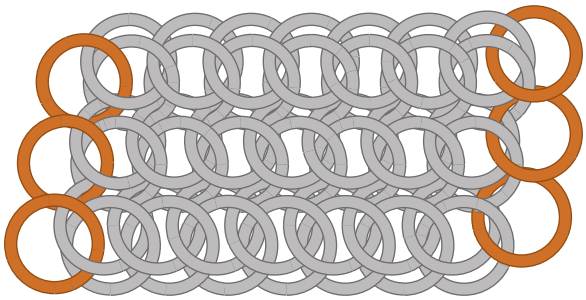


FIG. 13

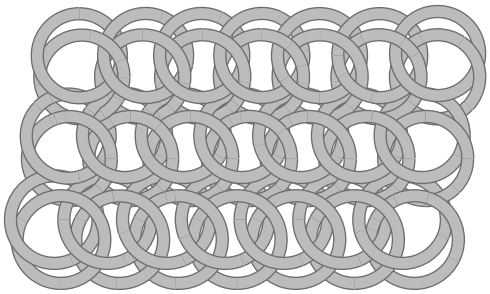


FIG. 14

Reversible Double Half-Persian 4-in-1 Collar

With Persian weaves, I always say more is more. So, what is better than one Half-Persian 4-in-1 chain? Why two, of course! I was inspired to use color as the main design principle after thinking about how useful it can be as a visual aid when learning this weave (Link Up, page 111). Then, when I put the two colored chains next to each other and turned them over, I was surprised and delighted by the alternate color option. It's reversible—how cool!

note: *The colors are reversed on each side, providing two ways to wear this lightweight collar.*

SUPPLIES

122 red anodized aluminum jump rings, 16g (SWG), ⅜″ (1 cm) ID

122 orange anodized aluminum jump rings, 16g (SWG), ⅜″ (1 cm) ID

122 bright aluminum jump rings, 18g (SWG), ⅛″ (3 mm) ID

10 bright aluminum jump rings, 18g (SWG), 5⁄32″ (4 mm) ID

2 base-metal two-strand connectors, 11.5 mm

1 base-metal toggle clasp, 17.5 mm

FINISHED LENGTH

15½″ (39.5 cm) not including clasp

FIG. 1

Make the Base Chains

1. Make two Half-Persian 4-in-1 chains, each using 61 red and 61 orange jump rings, following the instructions on page 106. Use one color for the base-row jump rings and the other color for the linking jump rings.

Connect the Chains

2. Match up the chains side by side, with the same colors touching. Orient the jump rings so that one chain is a mirror image of the other.

3. Open the ⅛″ (3 mm) bright aluminum jump rings.

4. Connect the chains using the open ⅛″ (3 mm) jump rings as follows:

   Thread 1 open jump ring through the first jump ring on one of the chains and then thread it through the matching jump ring on the other chain, joining the chains together. Close the jump ring.

   Continue in this manner along the length of the chains to join them together.

   Flip over the joined chains and connect the pairs of matching jump rings to form one chain.

Finish

5. Attach the clasp:

   Attach a 5⁄32″ (4 mm) jump ring to the loop of the toggle clasp.

   Attach the loop of the toggle clasp to a 2-strand connector by threading a 5⁄32″ (4 mm) jump ring through the jump ring just added to the loop of the clasp and the single side of the connector.

   Make a 1-1 chain (page 24) using 2 of the 5⁄32″ (4 mm) jump rings. Use 1 of the 5⁄32″ (4 mm) jump rings to attach the 1-1 chain to the bar of the toggle clasp.

   Attach the bar of the toggle clasp to the remaining 2-strand connector by threading a 5⁄32″ (4 mm) jump ring through the jump ring at the end of the 1-1 chain and the single side of the connector.

   Use 2 of the 5⁄32″ (4 mm) jump rings to attach a 2-strand connector to one end of the collar. Each loop of the connector should be attached, via one 5⁄32″ (4 mm) jump ring, to the 2 jump rings at the end of each of the Half-Persian 4-in-1 chains. Repeat on the opposite end of the collar with the other 2-strand connector (**FIG. 1**).

FORM FOLLOWS FUNCTION

When choosing the correct jump-ring size to make a piece of chain maille, you need to consider how you are going to use the weave. For example, in the Jump-Ring Sizing chart for the Half-Persian 4-in-1 Chain (page 106), I suggest using 16-gauge, 5⁄16″ (8 mm) ID jump rings. But, when I made sample pieces for this project, the joined lengths of chain seemed stiff. I had to increase a size in jump rings, using 16-gauge, ⅜″ (1 cm) ID jump rings, to allow the edges of the collar to curve around the neck.

When making projects of your own, test your design to find just the right materials to meet your needs. The sizes provided in the Jump Ring Sizing charts are based on the general appearance of the weave and should serve as starting points for creating your projects.

Dragonscale Weave

Well, I've saved the best for last. I call Dragonscale the holy grail of chain maille weaves; it's the one that everyone wants to learn. One look at this dense, lush pattern tells you why. It looks spectacular, feels slinky and smooth against the skin, and drapes beautifully.

The weave is made using two different sizes of jump rings and looks incredible in two different colors. The large jump rings encircle the smaller and stagger throughout, giving the weave its dragon-like texture. Dragonscale is dense and heavy and uses a lot of jump rings, so I've included a speed-weaving technique on page 123 to help you make quicker work of the weave. Use the eight rules for Dragonscale to troubleshoot common problems (page 125), create distinctive jewelry designs using small segments of the weave (page 125), and add embellishments with the Royal Dragonscale Collar (page 126). Using the step-by-step instructions in this chapter, you'll soon be weaving collars, cuffs, and belts of your own design.

Dragonscale Sheet Weave

Dragonscale may be the most complicated weave in this book, but that's no reason to be intimidated. This sheet weave belongs to the European family. Its start is similar to that of the Parallel Chain weave, and its method of construction reminiscent of the European 4-in-1 weave, adding jump rings in alternating rows of even and odd numbers. To make it even easier, I've compiled a list of rules to help you avoid the most common pitfalls. So relax, get your pliers ready, and go for it!

Jump-Ring Sizing

METAL	16-GAUGE		18-GAUGE	
	inner diameter	**rings per inch**	**inner diameter**	**rings per inch**
	large (small)	**large (small)**	**large (small)**	**large (small)**
Sterling silver (AWG)	8.0 mm (5.0 mm)	30 (30)	6.5 mm (4.0 mm)	40 (40)
Aluminum (SWG)	3/8" (7/32")	30 (30)	9/32" (3/16")	35 (35)

note: *I recommend using a starting aid to identify the beginning of your chain.*

Prepare Jump Rings

1. Close 5 large jump rings. Open the rest of the large jump rings and all small jump rings. Keep each size separate.

note: *You can use any Parallel Chain method you prefer, substituting pairs of small jump rings for single small jump rings, to make a start for Dragonscale. The preparation steps will vary with the method chosen. The preparation step above is that of the Speed Weaving Parallel Chain Method C (page 82).*

Start the Weave

The starter chain is 5 jump rings wide and uses 3 large jump rings, separated by 2 small jump rings. You can adjust the length of the starting chain using odd numbers only to make a wider or thinner Dragonscale Weave, as desired. Always begin your starting chain for this weave with a large jump ring.

2. Make a 1-1-1-1-1 chain alternating big and small jump rings as follows:

   Thread and close 1 small open jump ring through 2 large closed jump rings.

   Thread 1 small open jump ring through 1 of the large jump rings just added and 1 new large closed jump ring. Close the open jump ring and attach a starting aid to the center jump ring (**FIG. 1**).

3. Place 1 large closed (blue) jump ring over each of the 2 small (pink) jump rings (**FIG. 2**).

4. Thread and close a large open (yellow) jump ring through the 2 small (pink) jump rings, securing the large closed (blue) jump rings (**FIG. 3**).

5. To finish the row, thread and close a large open (yellow) jump ring through each small (pink) jump ring (**FIG. 4**).

Weave the Pattern

I like to flip over my weave as I weave Dragonscale, adding the large rings from the front of the weave and the small ones from the back. That way, I can ensure the small rings sit properly in the center of the large jump rings before I continue (**FIG. 6**).

Of course, you can add the small rings from the front, as long as you remember to check proper placement before you continue weaving. If the small rings are not properly placed, as shown in **FIG. 7**, the weave will become tight, making it impossible to keep weaving.

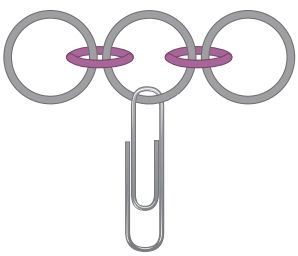


FIG. 1

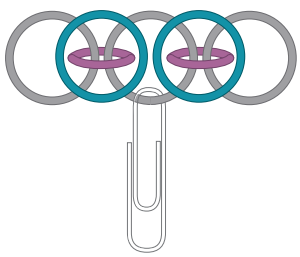


FIG. 2

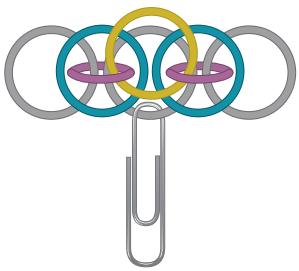


FIG. 3

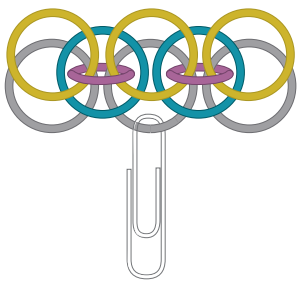


FIG. 4

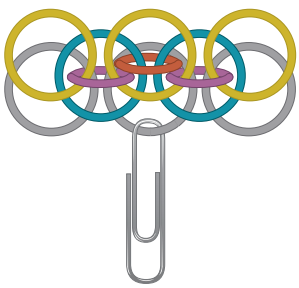
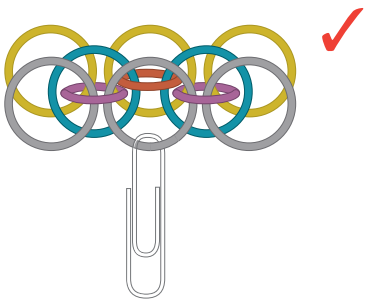
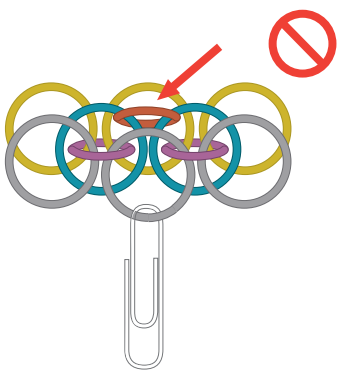


FIG. 5



Rear View (Correct)

FIG. 6



Rear View (Incorrect)

FIG. 7

6. Add a row of 3 small jump rings:

   Thread 1 small open (red) jump ring through the 2 large (blue) jump rings located under the top row of large (yellow) jump rings and then close it (**FIG. 5**).

   Now, flip over the piece and check the back. The small jump ring must rest in the center of the large jump ring in the previous row, not on top of it. If the small jump ring is sitting above, manually adjust it with your pliers. Refer to **FIGS. 6 AND 7,** which show the correct and then the incorrect placement. Flip over the piece to the right side.

   To finish the row, thread and close a small open (red) jump ring through each large (blue) jump ring located *under the top row* (**FIG. 8**).

   Flip over the piece and check the back to ensure that the small jump rings sit in the centers of the large jump rings in the previous row, not on top. If necessary, manually adjust their placement with your pliers. Flip over the piece to the right side.

7. Add a row of 2 large jump rings:

   Thread 1 large open (purple) jump ring through the center and right small (red) jump rings just added in Step 6 and then close it (**FIG. 9**).

   Thread 1 large open (purple) jump ring through the center and left small (red) jump rings and then close it (**FIG. 10**).

8. Add a row of 2 small jump rings:

   Thread 1 small open (dark blue) jump ring through the center and right large (yellow) jump rings located under the top row of large (purple) jump rings and then close it.

   Thread 1 small open (dark blue) jump ring through the center and left large (yellow) jump rings located *under the top row* of large (purple) jump rings and then close it (**FIG 11**).

   Now, flip over the piece and check the back. The small jump rings must rest in the center of the large jump rings in the previous row. If the small jump rings are sitting above, manually adjust them with your pliers, and then flip over the piece to the right side.

9. Add a row of 3 large jump rings:

   Thread 1 large open (orange) jump ring through the small jump rings just added in Step 8 and then close it.

   To finish the row, thread 1 large open (orange) jump ring through the left small jump ring and then close it. Repeat to add 1 large jump ring to the right (**FIG. 12**).

10. Repeat Steps 6–9 until the weave reaches the desired length.

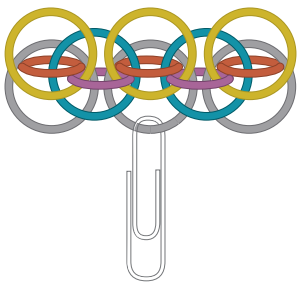


FIG. 8

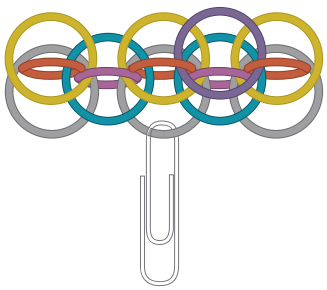


FIG. 9

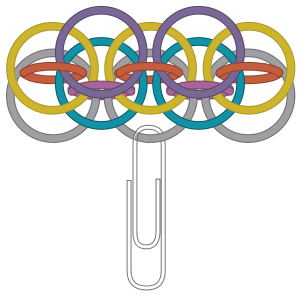


FIG. 10

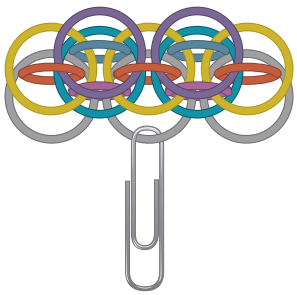


FIG. 11

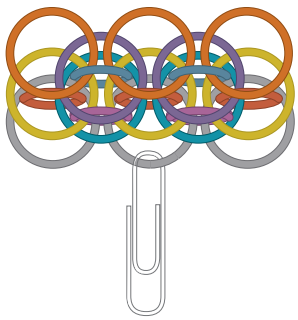


FIG. 12

Speed Weaving Dragonscale

The Dragonscale weave requires lots of jump rings, and opening all those jump rings takes time. As you build your skills, you'll want to save time in both the preparation and construction stages by speed weaving this pattern. Unlike the traditional Dragonscale technique, Speed Weaving Dragonscale requires jump rings to be added from the front of the weave only. Be diligent about checking the back of the weave as you work to ensure that all of the small rings are resting in the proper spot (**FIG. 6**, page 121).

Prepare Jump Rings

1. Open 7 of the small jump rings and close the rest. Close 5 large jump rings and open the rest.

Start the Weave

2. Make a starting chain using 8 large jump rings and 2 small jump rings, following the instructions for Speed Weaving Parallel Chain Method C and substituting 1 small jump ring where the Parallel Chain instructions call for 2 (**FIG. 1**). Attach a starting aid to indicate the start of the weave.

3. Arrange the jump rings on your work surface by pushing up the 3 large jump rings on the top of the piece, as shown in **FIG. 2**.

note: *The piece now has 3 rows of large jump rings: a bottom row of 3, a center row of 2, and a top row of 3.*

4. Add a row of 3 small open (pink) jump rings to the center row of 2 large jump rings, following Step 6 of the traditional Dragonscale Weave instructions (**FIG. 3**).

   Add a row of 2 small open (pink) jump rings to the top row of 3 large jump rings (**FIG. 4**).

note: *The remaining large jump rings should all be open, and the remaining small jump rings should all be closed.*

Weave the Pattern

Add 2 large jump rings and 3 small jump rings.

5. Thread 1 large open (orange) jump ring through the center and right small (yellow) jump rings of the previous row (**FIG. 5**).

6. Thread 2 small (blue) jump rings onto the large jump ring just added. Arrange the small jump rings as shown in **FIG. 6** and close the jump ring (**FIG. 7**).

7. Thread 1 large open (orange) jump ring through the center and left small (yellow) jump rings of the previous row and through the small center (blue) jump ring just added (**FIG. 8**).

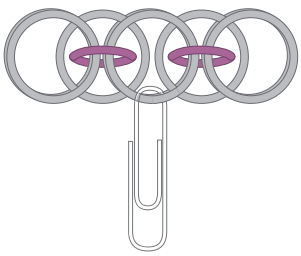


FIG. 1

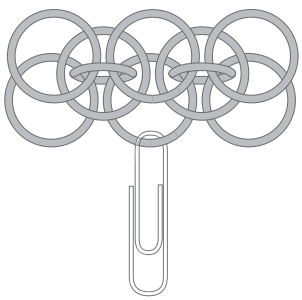


FIG. 2

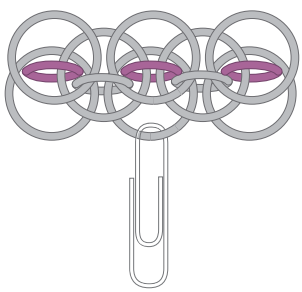


FIG. 3

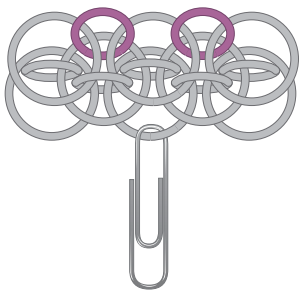


FIG. 4

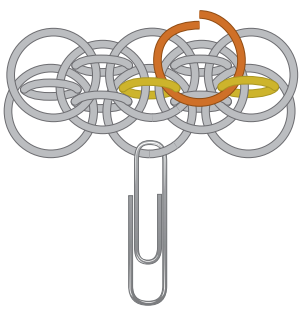


FIG. 5

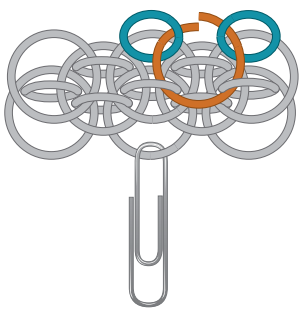


FIG. 6

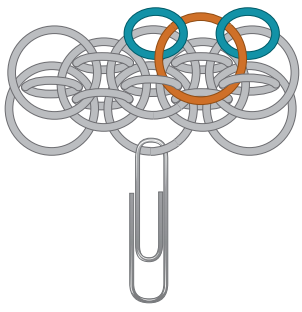


FIG. 7

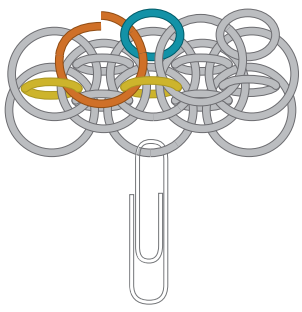


FIG. 8

8. Thread a small (green) jump ring onto the large jump ring just added. Arrange the small jump rings as shown in **FIG. 9** and close the jump ring (**FIG. 10**).

   Add 3 large jump rings and 2 small jump rings.

9. Thread 1 large open (orange) jump ring through the left and right small (yellow) jump rings of the previous row (**FIG. 11**).

10. Thread 2 small (blue) jump rings onto the large jump ring just added. Arrange the small jump rings as shown in **FIG. 12** and close the jump ring (**FIG. 13**).

11. Thread 1 large open (orange) jump ring through the right small (yellow) jump ring of the previous row and through the right small (blue) jump ring just added (**FIG. 14**).

12. Close the jump ring (**FIG. 15**).

13. Thread 1 large open (orange) jump ring through the left small (yellow) jump ring of the previous row and through the left small (blue) jump ring just added. Close the jump ring (**FIG. 16**).

14. Repeat Steps 5–13 until the weave reaches the desired length.

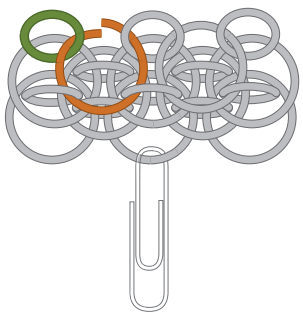


FIG. 9

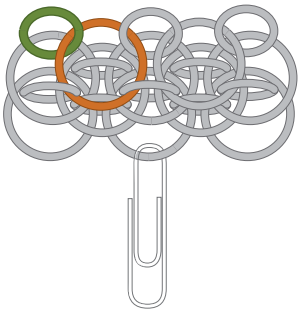


FIG. 10

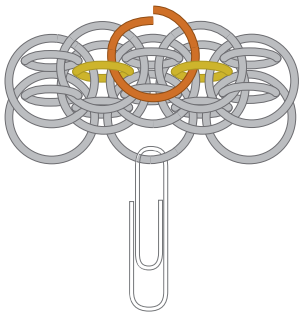


FIG. 11

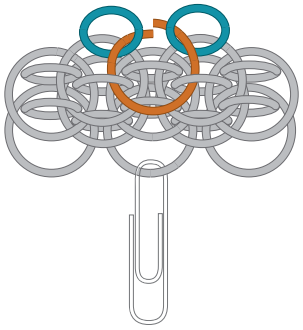


FIG. 12

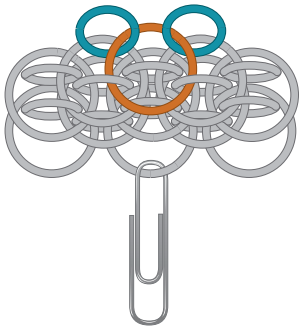


FIG. 13

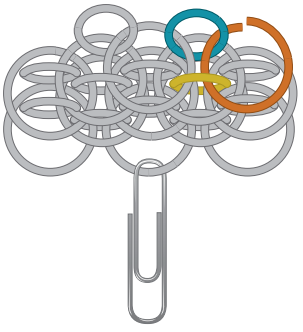


FIG. 14

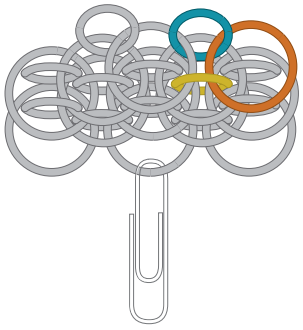


FIG. 15

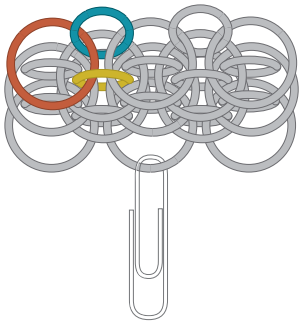


FIG. 16

The Rules

Now that we have a base to weave from, here are some helpful rules to remember. These rules represent the most common trouble spots encountered by my students:

Rule # 1:
Rows are added in alternating rows of large jump rings and small jump rings.

Rule # 2:
Jump rings are added in alternating even and odd rows. For example, after making a 5-jump-ring starter chain as shown, small jump rings will be added in rows of 3, 2, 3, and so on, and large jump rings will be added in rows of 2, 3, 2, and so on. Remember, you'll first add a row of small jump rings, then a row of large jump rings, then small, and then continue adding in this way until the weave reaches the desired length.

Rule # 3:
Small jump rings only connect to large jump rings.

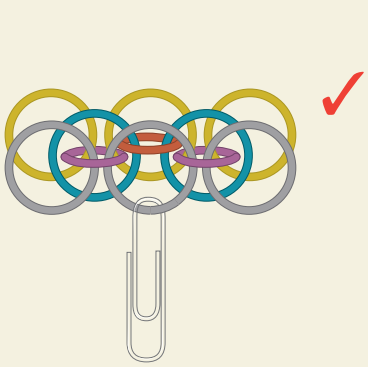
Rule # 4:
Large jump rings only connect to small jump rings.

Rule # 5:
Small jump rings are added to the row of large jump rings that is *under* the top row of large jump rings.

Rule # 6:
Large jump rings are added on top of the weave, into the last row of small jump rings.

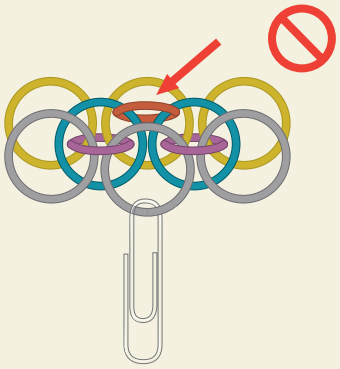
Rule # 7:
Look at the back of the weave to make sure the small jump rings sit *in the center* of the large jump rings in the previous row, *not on top*. Otherwise the weave will become too tight to construct (**FIGS. 6 AND 7**). This is crucial!

Rule # 8:
Stock your music playlist with your favorite songs and have fun!



Rear View (Correct)

FIG. 6



Rear View (Incorrect)

FIG. 7

TRY THIS:

Dragonscale Key Chain

I was just messing around with some leftover aluminum jump rings and made a cute little key chain from a segment of Dragonscale. The segment consists of 19 large jump rings and 19 small jump rings and is tapered at both ends. I was inspired by this little keychain to make a bracelet and then a necklace combined with Half-Persian 4-in-1. There are a lot more design possibilities to explore!

Royal Dragonscale Collar

This project showcases many of the techniques you will have mastered in this book, Half-Persian, Byzantine, and of course, the culmination of the skills you've developed—Dragonscale. For such an achievement, I think it's best to go big, and you'll be sure to command attention in this show-stopping collar.

Because a collar is a big piece and Dragonscale uses many jump rings, I wanted to be sure the finished necklace was lightweight, so anodized aluminum jump rings were a good choice. They also come in many colors, helping the design to pop.

SUPPLIES

269 black ice anodized aluminum jump rings, 16g (SWG), ⅜″ (1 cm) ID

214 black anodized aluminum jump rings, 18g (SWG), ¼″ (6 mm) ID

155 dark purple anodized aluminum jump rings, 18g (SWG), ¼″ (6 mm) ID (53 for Dragonscale, 102 for edging)

243 black ice anodized aluminum jump rings, 18g (SWG), 5⁄32″ (4 mm) ID

4 bright aluminum jump rings, 18g (SWG), 7⁄32″ (5.5 mm) ID

7 bright aluminum jump rings, 18g (SWG), ⅛″ (3 mm) ID

27 purple velvet Swarovski crystal round beads, 6 mm

27 base-metal head pins

2 base-metal two-strand connectors, 11.5 mm

1 base-metal toggle clasp, 17.5 mm

FINISHED LENGTH

13″ (33 cm) inner edge (not including clasp)

Dragonscale

1. Make a piece of Dragonscale following the instructions for the traditional Dragonscale Weave, page 121, or for Speed Weaving Dragonscale, page 123. Use the jump rings as follows:

   The 16g, ⅜″ (1 cm) black ice jump rings represent the large jump rings in the weave.

   The 18g, ¼″ (6mm) black jump rings and 53 of the 18g, ¼″ (6 mm) dark purple jump rings represent the small jump rings in the weave and are arranged in the weave as follows:

   Rows of 2 small jump rings: black jump rings.

   Rows of 3 small jump rings: black jump ring, dark purple jump ring, black jump ring.

2. Taper both edges of your Dragonscale piece following the instructions in Tapering the Ends of the Dragonscale Weave, page 136.

Half-Persian

3. Make a decorative Half-Persian 3-in-1 border along the inner edge of the Dragonscale using the 102 remaining ¼″ (6 mm) dark purple jump rings, just as you would add an additional row of Half-Persian 3-in-1 to a base chain to form a sheet (page 114, Steps 5–9).

4. Add the edging in two stages, as follows:

   Working on the inner edge of the Dragonscale, weave the small dark purple jump rings through pairs of the large black ice jump rings in the same way as you would weave jump rings through pairs of the previous row of linking jump rings to build an additional row of Half-Persian 3-in-1 Sheet (as in Steps 5–7, page 114).

   Weave the remaining small dark purple jump rings through the small dark purple jump rings just added in the same way as you would complete an additional row of Half-Persian 3-in-1 Sheet, by weaving linking jump rings

through the row of base-row jump rings just added (as in Steps 8–9, page 114).

Byzantine

5. Add 27 small Byzantine segments, each consisting of 8 small 5/32" (4 mm) black ice jump rings, to the outer edge of the collar as follows:

   Beginning with the first large black ice jump ring on the collar, make a Byzantine segment on every other large black ice jump ring, following the instructions for the Byzantine Weave on page 32, Steps 2–4.

   Thread each bead onto a head pin and make a wrapped loop (page 137) at the end of each head pin to make the crystal dangles.

   Attach each crystal dangle to each Byzantine segment using a 5/32" (4 mm) black ice jump ring.

Finish

6. Attach the clasp.

   Attach a 1/8" (3 mm) bright aluminum jump ring to the loop of the toggle clasp.

   Attach the loop of the toggle clasp to a 2-strand connector by threading a 1/8" (3 mm) bright aluminum jump ring through the jump ring just added to the clasp and the single side of the connector.

   Make a 1-1-1 chain (page 24) using 3 of the 1/8" (3 mm) bright aluminum jump rings.

   Use a 1/8" (3 mm) bright aluminum jump ring to attach the 1-1-1 chain to the bar of the toggle clasp.

   Attach the bar of the toggle clasp to the other 2-strand connector by threading a 1/8" (3 mm) bright aluminum jump ring through the jump ring at the end of the 1-1-1 chain and the single side of the connector.

   Use 4 of the 7/32" (5.5 mm) bright aluminum jump rings to attach the 2-strand connectors to the small jump rings at both tapered ends of the Dragonscale collar, following the instructions for attaching clasps to Dragonscale, page 136.

TIP: The curve of the collar is created by adding the border, contracting the Dragonscale Weave on that edge. When creating a curve in this manner, you must make the piece a bit longer than the desired finished length, as you will lose length in the process of contraction.

If you want to add a border without affecting the length and shape of the edge, increase the inner diameter of the jump rings used to construct the border.

BEING FLEXIBLE

Creating successful jewelry designs often means being flexible—with your vision for the project and your materials. When I first decided to make a Dragonscale collar, I wanted to use anodized aluminum jump rings, for their color and light weight, but I discovered that I couldn't find the small jump rings in both the sizes (Dragonscale Jump-Ring Sizing chart, page 120) and in the colors I wanted. For this project, I felt strongly about the color, so I decided to go with a recommendation for a small jump ring in a different gauge and just hope for the best.

I discovered that the weave was a bit looser than I like it to be for something such as a bracelet, but this was an advantage for a collar. The extra movement provided by the size substitution improved the drape of the piece. It also led me to add the inner edging, which was not in my original vision, but I think it enhances the look of the piece.

I call occurrences such as this "happy accidents." May you have many of your own.

Finishing

Now that you've learned a nice selection of weaves, what will you make with them? You can make necklaces, earrings, bracelets, watches, rings, belts, key fobs, and bails. To begin, add a simple clasp to any of the chain weaves you've made while learning the techniques—and now you've got a bracelet or a necklace. Attach ear wires to a couple of chain maille units and you've got a fabulous pair of earrings. Connect a bail to a third unit and you've got a matching pendant. Add a multi-strand clasp to a sheet weave and you've got an awesome cuff. And that's just for starters. Add embellishments such as beads, crystals, semi-precious stones, bits of chain or leather, rubber O-rings, scales, and more. Experiment with jump rings of different sizes, colors, metals, and wire shapes and textures. Mix and match elements of different chain maille weaves.

This chapter includes everything you need to know to create objects that are uniquely your own—from instructions for attaching all kinds of findings on page 133 to tools and tips for jewelry design on page 139 to caring for and polishing all the new pieces you've made on page 142.

Findings

Attachments and findings are the final elements needed to turn your weaves into finished pieces of jewelry, from ear wires to clasps, bails, and chain to head pins, eye pins, and so much more. Findings are typically attached to jewelry using jump rings, and it's best to have several sizes of jump rings on hand specifically for attaching your findings.

For security, I recommend using jump rings of the thickest gauge that seems appropriate for the scale of your piece, keeping in mind how much stress a piece of jewelry may take. A bracelet clasp, for example, would need to be attached with a stronger jump ring than a lightweight pendant. A small inner diameter also increases security as does using multiple jump rings to make attachments.

You can purchase findings from jewelry suppliers (Resources, page 144) or you can make your own.

Attaching findings to most of the weaves in this book is fairly simple: Just use a jump ring or two to add a clasp to the end of the chain. Sheet weaves and Round Maille weaves require a few additional steps, included in the pages that follow.

CHOOSING FINDINGS

Choosing the appropriate finding can, literally, make or break your jewelry. Choose a style and size that complements your piece. A hefty bracelet should have a clasp, for example, that matches its look and also can bear its weight. A small clasp will suit a delicate piece but must be easy to operate. Always consider the size, weight, type of metal, and wearer when choosing findings.

Ear wires Ear wires come in many sizes and styles, including French wires, lever backs, and posts. Keep in mind that some people are allergic to base metals such as nickel, but it's usually safe to stick to precious metals such as sterling silver and gold, or try hypoallergenic titanium.

Ear wires are generally attached using a jump ring. Make sure the front of the earring is in line with the front of the ear wire. You may need to add an additional jump ring to ensure the earring faces forward when worn (**FIG. 1**). I like to attach ear wires using small jump rings (18–22g, with a 2–3 mm ID) so the attachment does not compete with the design (**FIG. 2**).

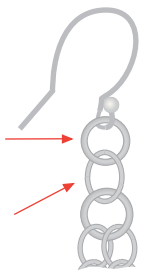


FIG. 1

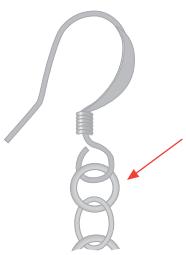


FIG. 2

Bails A large jump ring, or a few jump rings used together, can be used as a bail to support a pendant or charm (**FIG. 3**). When purchasing a bail, make sure the place of attachment is in the proper orientation to attach to your piece (**FIG. 4**) and that it is properly sized for the chain and pendant.

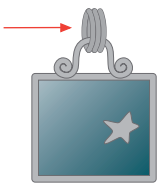


FIG. 3

FIG. 4

Clasps As with ear wires, clasps come in a variety of sizes and types: toggles, lobsters, hooks, S-clasps, slide clasps, magnetic clasps, and so many more. Different types of clasps require varying degrees of manual dexterity to operate, so in addition to considering which clasp will look best with your piece, think about who will be wearing your jewelry. For example, if you are designing for someone with arthritis, you may want to use a magnetic clasp or a toggle instead of a lobster clasp. Larger clasps are usually easier to operate than smaller clasps.

When adding a clasp, check the orientation of the attachment or use a swivel clasp (**FIG. 5**). Toggle clasps

usually require extra links of chain to allow the bar to slide freely through the loop (**FIG. 6**).

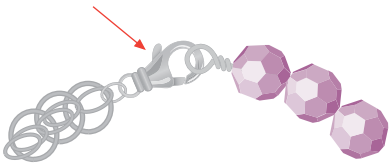


FIG. 5

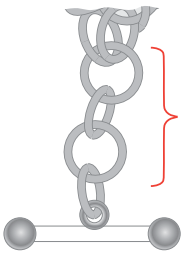


FIG. 6

ATTACHING FINDINGS TO STRAIGHT CHAIN WEAVES

Attaching findings to straight chain weaves is a simple process, most commonly approached in one of two ways:

1. Use jump rings to attach the clasp to the ends of the weave (**FIG. 7**).
2. Integrate the clasp into the weave:

   At the starting end of the chain, begin your weaving on the clasp (as you would a starting aid).

   When adding the last jump ring (or pair of jump rings) onto the finishing end of your chain, thread the clasp through the last jump ring(s) before closing.

I like to use the smallest jump rings possible, keeping in mind the scale and weight of the piece, so that the attachment does not compete with my design. Even a small-gauge jump ring will be strong enough if the aspect ratio is tight. You can use multiple jump rings, if desired, to reinforce the attachment. You can further embellish the terminations by using decorative end caps at each end of your chain (Using End Caps, page 135).

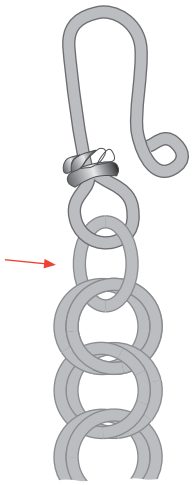


FIG. 7

ATTACHING FINDINGS TO ROUND MAILLE WEAVES

The end of a Round Maille weave consists of three jump rings in a triangular arrangement, so there is no direct route straight through the end of the chain for you to weave in a jump ring. If you have some metal or wireworking skills, you could fashion your own attachment mechanism. But there also are several methods of terminating Round Maille (triplicate) weaves, so you can find the one that works best for you.

Method A

This simple method can be used for any of the Round Maille weaves. However, it is not the most elegant, and I usually use this method only if I intend to cover the end with an end cap (Using End Caps, page 135).

1. Attach 1 open jump ring to jump rings 1 and 2 at the end of the weave and then close it.
2. Attach another open jump ring to jump rings 2 and 3 at the end of the weave and then close it.
3. Thread 1 open jump ring through your clasp and the 2 jump rings just added and then close it.
4. Finish the other end of the chain in the same manner (**FIG. 8**).

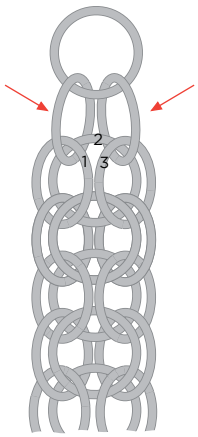


FIG. 8

Method B

Method B can be used with Round Maille and Turkish Round Maille, as these are the Round Maille weaves that require you to fold back jump rings in the weave. You need to bring each end of the chain to the Fold Back and Spread step. This is accomplished differently on each end.

1. Prepare the ends of the chain:

   To bring the finishing end of the chain to the Fold Back and Spread condition, simply stop weaving when you reach this point.

   To bring the starting end of the chain to the Fold Back and Spread condition, perform one of following steps:

   Option 1: Remove the first 3 rings of the chain.

   Option 2: For Round Maille, add 3 more rings (in pattern).

   Option 3: For Turkish Round Maille, add 6 more rings (in pattern).

2. Choose your method of attachment.

   Use 2 jump rings to terminate the end:

   Using 2 appropriately sized open jump rings, thread 1 open jump ring through jump rings 1 and 2 of the inner triangle (**FIG. 6**, page 91) and the clasp, then close it.

   Now thread the other open jump ring through jump rings 2 and 3 of the inner triangle and the clasp and then close it (**FIG. 9**).

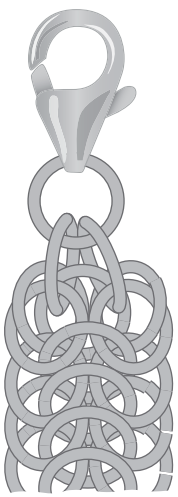


FIG. 9

Use 1 jump ring to terminate the end:

Use an open jump ring with an inner diameter 1 mm to 2 mm larger than the weave to scoop up all 3 jump rings of the inner triangle (**FIG. 10**).

note: *You may need to wiggle the jump ring a bit to grab all 3 inner rings.*

If this jump ring will serve as the clasp's catch, simply close the open jump ring. If you are attaching a clasp, thread the clasp onto the open jump ring, and then close it.

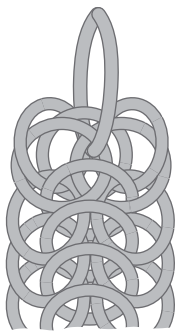


FIG. 10

TIP: The type of clasp I use dictates my choice of attachment method. For a one-part clasp (such as a lobster clasp), I use 2 jump rings to attach the clasp to one end of the chain and 1 jump ring to create the catch on the other end.

For a two-part clasp (such as a toggle clasp), I attach each part of the clasp to the ends of the piece using 2 jump rings.

Method C

Method C is used for Inverted Round Maille weaves and differs from Method B in the preparation phase only—just fold back the ends of the chain.

1. Prepare the ends of the chain:

   Fold Back and Spread the 3 jump rings at each end of the chain.

   note: *This will create a decorative rim at each end of the chain and will also create an inner triangle on each end of the chain.*

2. Attach your clasp following Method B, Step 2 (either option) (**FIG. 11**).

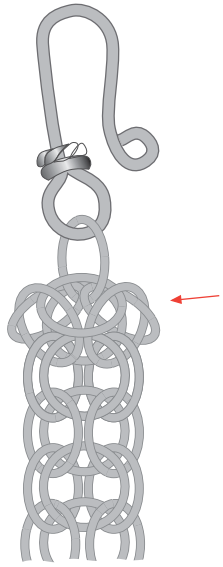


FIG. 11

Using End Caps

To embellish the terminations on your Round Maille chains, consider using a decorative end cap. You will need the following additional tools and supplies:

2 end caps appropriately sized for your chain

6–8″ (15–20.5 cm) of wire

Wire cutters

Round-nose pliers

note: *The length of the wire needed will depend on the size of your piece and the end caps chosen. A reasonable estimate is 3 to 4″ (7.5 to 10 cm) per end. The gauge of the wire will depend on the scale of the piece. Most often, I use 18- to 20-gauge wire. I prefer to match the metal of the wire to the piece.*

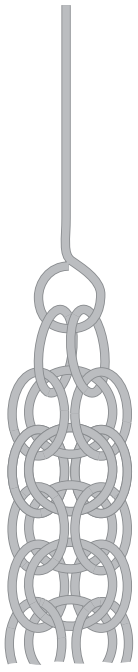


FIG. 1

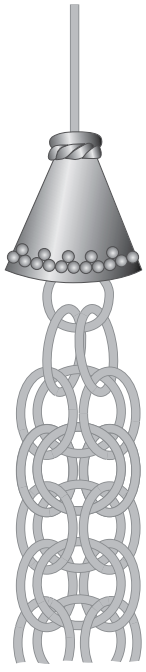


FIG. 2

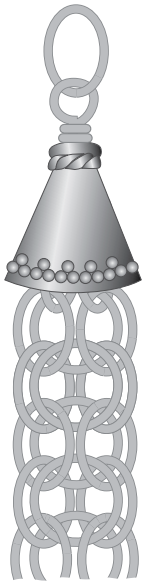


FIG. 3

Prepare

1. End your Round Maille weave following Method A, Steps 1 and 2, page 133.

Attach the End Caps

2. Use wire cutters to cut wire to the desired length.
3. Use round-nose pliers to make a loop at one end of the wire. Gather the 2 jump rings at the end of the chain in the loop and use chain-nose pliers to close the loop (**FIG. 1**).
4. Thread an end cap on the wire just added to the chain (**FIG. 2**).
5. Secure the end cap to the chain by using round-nose pliers to make a wrapped loop at the end of the chain.
6. Repeat on the other end of chain.
7. Use jump rings to attach your clasp to the wrapped loops on the ends of the chain (**FIG. 3**).

ATTACHING FINDINGS TO SHEET WEAVES

Sheet weaves require the use of multiple-strand clasps. Depending on the weave, extra refining of the ends of the weave may be desired.

European 4-in-1 The edge jump rings of the European 4-in-1 weave tend to be unstable because these jump rings are attached to the piece on only one side (**FIG. 12**). Therefore, I like to attach the clasp to the inner rows of the weave for greater stability (**FIG. 13**).

Use a multiple-strand clasp that has the same number of attachment loops as inner rows. Taper the ends of the piece by removing the two outer jump rings at the ends, eliminating the unstable jump rings.

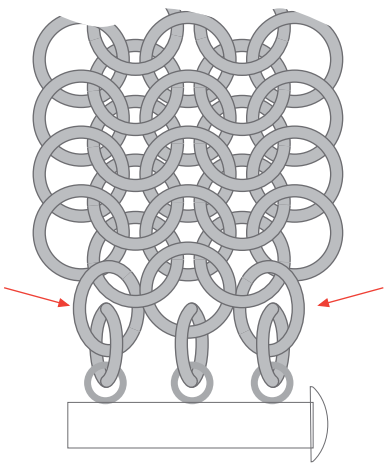


FIG. 12

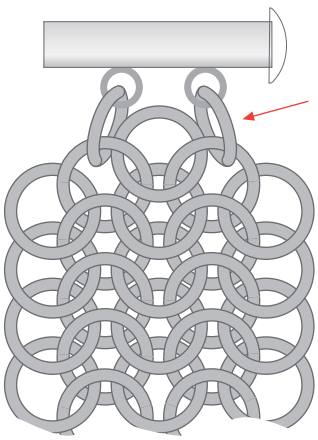


FIG. 13

Half-Persian 3-in-1 Attaching a clasp to the Half-Persian 3-in-1 weave is straightforward. Use a multiple-strand clasp that has the same number of attachment loops as the number of rows on your piece. Attach the clasp by threading a jump ring through each loop of the clasp and the two corresponding jump rings at the end of each row of the weave (**FIG. 14**).

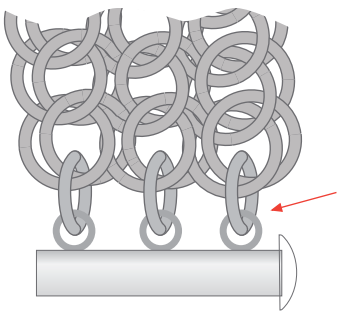


FIG. 14

Dragonscale The edge jump rings of the Dragonscale weave tend to be unstable, just as the jump rings on the edges of the European 4-in-1 Weave (**FIG. 15**). Use the following instructions to taper the ends of Dragonscale and attach the clasp to the more stable small jump rings of the inner rows (**FIG. 16**). Use a multiple-strand clasp that has the same number of attachment loops as the number of small jump rings of the inner rows.

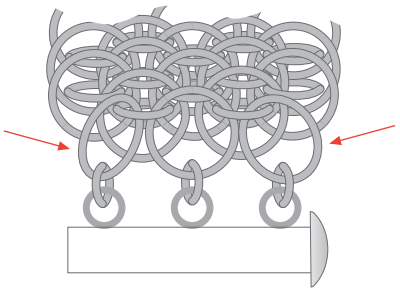


FIG. 15

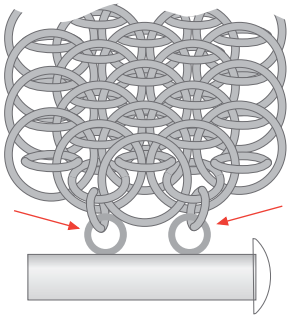


FIG. 16

Tapering the Ends of the Dragonscale Weave

If weaving the traditional method:

1. Remove the left and right large jump rings from the finishing end of the piece.
2. Flip the piece over and remove the left and right large jump rings from the starting end of the piece.

If speed weaving:

1. Remove the left and right large jump rings from the finishing end of the piece.
2. Remove the top row of small jump rings at the finishing end of the piece.
3. Remove the next row of small jump rings, now on top, at the finishing end of the piece.
4. Flip the piece over and remove the left and right large jump rings from the starting end.

MAKING LOOPS

Eye pins, head pins, and loops allow you to attach findings, beads, charms, and other decorative elements to your jewelry. There are two basic types of loops: the simple loop and the wrapped loop.

LOOP-MAKING TOOLS AND SUPPLIES

Wire cutters

Round-nose pliers

Chain-nose pliers

Crimping pliers

Wire, head pins, or eye pins

Beads or other embellishments

Making a Simple Loop

1. Using round-nose pliers, grab the tip of a piece of wire.
2. Roll the tip of the wire down until it is even with the outer edge of the length of wire, forming a shape like the letter P (**FIG. 17**).

FIG. 17

3. Next you need to "break the neck" to center the loop over the length of wire as follows: Place the jaws of the round-nose pliers in the loop at the point where the tip of the wire crosses the length of wire and bend the loop back, centering it over the length of wire (**FIG. 18**).

FIG. 18

note: *If making a simple loop on top of a bead, trim the wire tail to about ⅓" or ½" (8.5 mm or 1.3 cm), and bend it back 90 degrees. Then, grab the tip of the wire with round-nose pliers and roll it back down to the bend, creating a loop. Center the loop over the top of the bead and use wire cutters to trim any excess wire. Cover the cutters with your hand as you trim so the excess wire does not become a projectile.*

Making a Wrapped Loop

1. Place a bead onto a head pin.
2. Place round-nose pliers horizontally against the top of the bead, the jaws straddling the wire.
3. Bend the wire back 90 degrees, over the jaw of the pliers (**FIG. 19**).

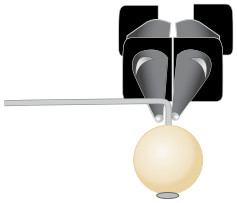


FIG. 19

4. Rotate the pliers vertically and grip the wire at the bend. With your other hand, bring the end of the wire up and over the top jaw of the pliers until you cannot go any farther and the wire is pointing down (**FIG. 20**).

FIG. 20

5. Remove the top jaw of the pliers from the loop and insert the bottom jaw of the pliers in the loop. With your other hand, bring the wire down around the bottom jaw of the pliers, completing the loop and leaving the wire in a horizontal position (**FIG. 21**).

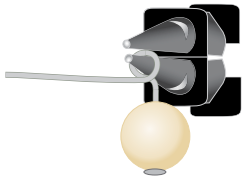


FIG. 21

6. With your round-nose pliers still in the loop, grasp the end of the wire with a pair of flat- or chain-nose pliers and wrap the tail of the wire around the wire under the loop 2 or 3 times, filling the space between the loop and the bead (**FIG. 22**).

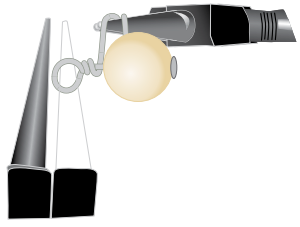
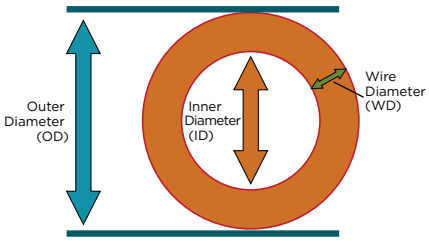


FIG. 22

7. Trim the excess wire with wire cutters.
8. Use crimping pliers or chain-nose pliers to snugly tuck in the end of the wire tail against the wrap.

Chain Maille Design 101

When I bring new designs into my classes, my students always ask me how I came up with those particular designs. My answer usually begins with, "Well, I was just kinda playin'. . ." and with design, that is just the point. Don't be afraid to play. Ask yourself *what if* and then just try it. Let your designs develop organically and feel free to explore and experiment. If you make something that doesn't work, figure out what you don't like about it and change it. If you hit a hurdle, don't give up but try a different approach. Make substitutions. Break some rules. Turn your design inside out and upside down. Put all of your goodies on the table and mix and match. Just have fun! You may end up surprising yourself.



DETERMINING ASPECT RATIO

The easiest way to start designing your own pieces is to experiment with aspect ratio to produce tighter or more open weaves. Make chains finer or heavier using jump rings of a different gauge. Graduate the size of the jump rings you use to weave your chains. You could use larger rings in the center of your chain and smaller rings at the ends for a tapered effect. Or you could evenly space large and small rings along the length of your chain to create an undulating weave. You might even want to use jump rings made of shaped, textured, or colored wire, or add a few special jump rings as accents.

Your options truly are limitless, as long as you maintain the correct aspect ratio for each weave. You can determine the ideal aspect ratio in two ways: by using a simple formula or by using the Aspect Ratio Charts on pages 145–155.

Do the Math

You can use the following formula to determine the jump-ring size you'll need for any chain maille weave:

$$\text{Aspect Ratio (AR)} = \frac{\text{Inner Diameter (ID)}}{\text{Wire Diameter (WD)}}$$

Suppose you want to make a Byzantine Weave using 20g silver jump rings. First determine the aspect ratio for the Byzantine Weave by plugging the information you already know about 16g and 18g jump rings from the Byzantine Jump-Ring Sizing chart and the Wire-Scale Comparison Chart (page 12) into the aspect ratio formula:

$$\text{AR (16G)} = \frac{4.5\text{ MM}}{1.29} = 3.5$$

- OR -

$$\text{AR (18G)} = \frac{3.5\text{ MM}}{1.02} = 3.4$$

AR = 3.4–3.5

Now, you can use the calculation AR x WD = ID to determine the inner diameter size you will need to purchase to make the weave using 20g jump rings:

AR (of Byzantine Weave) x WD (of 20g jump rings) = ID (of 20g jump rings)

AR (3.4–3.5) x WD (0.81) = ID (2.75–2.83 mm)

The ideal inner diameter for 20g silver jump rings is between 2.75 mm and 2.83 mm.

Keep in mind, the calculations in the formula above provide guidelines only, as mathematical calculations do not consider differences in actual manufacturing.

Use the Aspect Ratio Charts

In the back of this book, you'll find charts for common gauges that include outer and inner diameters and aspect ratios. You can use these Aspect Ratio Charts to determine alternate sizes needed for converting weaves to jump rings of different gauges—no math necessary!

We'll follow the same example as above, converting a Byzantine Weave to 20g silver jump rings. First, consult the Byzantine Jump-Ring Sizing chart to determine the recommended inner diameter for this weave: A 16g sterling silver jump ring should have an inner diameter of 4.5 mm and an 18g sterling silver jump ring an inner diameter of 3.5 mm. Next, turn to the Aspect Ratio Charts (AWG) in the back of the book, page 147, to find the aspect ratio for these jump rings. You'll see that the aspect ratio is about 3.4 to 3.5". Then refer to the 20g Aspect Ratio Chart (AWG) on page 148 to find the rounded aspect ratio within the 3.4 to 3.5 range—in this case a 2.75 mm inner diameter jump ring has a 3.4 aspect ratio.

EXPERIMENTING WITH CHAIN MAILLE

Use the basic techniques and projects in this book as a springboard for substitutions and experimentation. Combine elements of different weaves to create a unique piece of jewelry or develop a new chain maille pattern of your own design. The following ideas will help you get started.

EMBELLISH The even, consistent patterns of chain maille lend themselves to embellishments of all kinds.

Add a watch head or a special focal piece to your jewelry.

Connect beads, crystals, pearls, semi-precious stones, and charms to your jewelry using loops and other simple wireworking techniques.

Introduce new materials into your designs such as rubber O-rings, leather, scales, and premade cable chain.

BE CHOOSY Make sure every aspect of your design reflects your intentions—from materials to scale to wearability.

Choose appropriately sized jump rings to construct your piece, keeping in mind not only appearance but also intended purpose.

Choose the appropriate findings (page 132).

Choose to work with materials that you'll be proud to wear and give as gifts.

BE PREPARED Keeping your stash of supplies well stocked means you always have just what you need—and you're ready for unexpected accidents and last-minute inspiration.

Buy more jump rings and other materials than you need. You may decide along the way that the bracelet you are working on would make a better necklace, or you may have a great idea that you need to act on now, before you forget!

Have a selection of clasps, ear wires, and other findings on hand. Sometimes it's hard to tell what will work best until the item is complete.

GET FIT Consider how the jewelry will be worn and who will be wearing it. A piece of jewelry that fits is a piece that will be worn again and again.

When creating a piece of jewelry, try it on and make adjustments as you go.

Rings must fit, period. They should be comfortable to wear and they should not prevent you from moving your fingers or putting your hands in your pockets! Refer to Ring Sizing, page 65, for guidelines on finding the correct diameter for chain maille rings.

When possible, fit bracelets to the correct length for the wearer. Standard length for bracelets is 7 to 7½" (18 to 19 cm).

Necklaces can come in a wide range of lengths. The 16 to 20" (40.5 to 51 cm) lengths are most common. Try to match the length of a necklace with the neckline of the garment you intend to wear it with.

Make earrings as lightweight as possible. They'll be more comfortable and won't stretch out your earlobes!

DO IT YOURSELF There are a wealth of resources at the bookstore, library, and online that include instructions for making your own findings and other wireworking techniques. Of course the best way to learn is to just start working with wire.

Make your own clasps. Toggles, hooks, and S-clasps are among the easiest to make.

Make your own ear wires. I recommend using 20g half-hard wire for ear wires. Don't forget to file the cut ends smooth so you don't scratch yourself when putting the ear wire through your ear.

Make your own decorative head pins. Hammer the end flat to make a paddle shape or use pliers to create a decorative swirl.

PLAY! This is the most important suggestion of all. Just have fun and let designs develop naturally.

Final Finish

Nothing makes a piece of jewelry look quite so impressive as an incredibly bright shine, so I like to tumble polish my finished silver chain maille. Have your sunglasses handy! The tumbling process doesn't really remove metal, but rather it is as if the jewelry is being hit by lots of little hammers, smoothing the surface to make it shine. The tumbling process also helps to work-harden the jump rings, adding strength to the finished piece.

Certain types of beads or stones should never be put into the tumbler, as they may crack or discolor. I've tumbled dichroic glass cabochons and uncoated Swarovski crystals without incident, but it's a good idea to test a spare bead or stone by tumbling it alone before you tumble the actual piece, just to be safe. Of course, a hidden flaw in a bead may cause it to break when tumbled as well. My advice: *When in doubt, leave it out!*

Tumbling is a fairly gentle process, but you must use common sense when loading the tumbler. Don't put heavy or hard items in with delicate or soft items to avoid damage. Fine chains are prone to tangling around themselves or other items in the tumbler. Inspect your chain maille when it comes out of the tumbler. Sometimes a stray piece of shot can become lodged in the chain maille weave and will need to be removed. A few times, I've had the jump rings in a piece of chain maille shift position in the weave after tumbling, necessitating a quick repair.

To tumble polish your jewelry, you'll need a rotary tumbler, some tumbling media (shot), dish soap or a burnishing liquid, and water. There are many fine brands of tumblers on the market. Buy one based on your needs and your wallet. The supplies needed can be purchased through jewelry supply outlets (page 144).

I recommend mixed stainless steel shot, which contains a variety of shapes for fitting into nooks and crannies. The mixes I use do not have pins; the long, thin, pointy shapes that often become buried in chain maille weaves. You'll also need a burnishing liquid, such as liquid dish soap. I tumble one handful per barrel of sterling silver jewelry for at least two hours in a Lortone 33B double-barrel rotary tumbler with stainless steel mixed shot (2 lbs [about 1 kg] of shot per 3 lb [1.3 kg] barrel) and Rio Grande's Super Sunsheen burnishing compound mixed with water, as per product directions.

To clean anodized aluminum, simply wash the jump rings with dish soap and warm water to keep them clean. Do not tumble this metal, as the color is just a surface treatment.

If you like the look of oxidized metal, you can use liver of sulfur to give your piece that aged, ancient look. Use caution when oxidizing a piece that contains beads or stones and, in general, when working with chemicals. You can find liver of sulfur at most jewelry supply outlets.

Maintenance and Storage

With sterling silver, tarnish is always an issue. When a silver piece begins to look a bit dingy, I will throw it into the tumbler, if I've got an hour or two. If I've got about 10 or 15 minutes, I do one of two things:

Gently burnish the piece with a jeweler's soft brass brush and lots of dish soap and water.

Make a paste of baking soda and water and, with an old soft toothbrush, gently scrub the piece with the paste. (This cleanser also works great on my tea kettle.)

Both methods produce a softer satin finish, as opposed to the high polish achieved through tumbling. Use care around beads and stones as they could become scratched and follow by rinsing the piece with water and drying it well with a soft cloth. Using a silver polishing cloth is another quick solution for tarnish.

To help avoid tarnish on silver in the first place, I store my pieces in plastic zip-top bags to minimize their exposure to the atmospheric compounds that promote oxidation. When I take off my silver jewelry at night, I use rubbing alcohol on a cotton pad to wipe off any perfumes, oils, lotions, makeup, or sweat that may have transferred from my body to the jewelry. If you choose to do this, avoid getting alcohol on beads or stones as it might be detrimental to the finish. When in doubt, just wipe with a soft cloth. Of course, common-sense practices such as taking off jewelry before sleeping, swimming, showering, or exercising will help to keep it like new.

Abbreviations

AE around the eye connection

AR aspect ratio

AWG American wire gauge

CM centimeter

G gauge

ID inner diameter

OD outer diameter

MM millimeter

SWG British standard wire gauge

TE through the eye connection

WD wire diameter

Resources

There is a vibrant and active maille community online. Maillers are generous people who are passionate about their craft and about sharing knowledge. Here are a few of my favorite sites that are definitely worth checking out:

For informative articles, tutorials, and helpful links, check out the Maille Artisans International League website. They are an online international community of chain maille artisans whose mission is to share and archive chain maille information. *mailleartisans.org*

For tutorials, CGMaille.com (Phong's Chainmaille Tutorials), complete with beautiful computer-generated illustrations, is the place to go. *cgmaille.com*

For technical data and charts, articles, and a few tutorials, check out *chainmailbasket.com*.

In addition, Urban Maille (*urbanmaille.com*) and The Ring Lord (*theringlord.com*) have useful chain maille information posted on their websites.

Taking classes is a wonderful way to learn. Many bead shops now offer classes in chain maille techniques, and you also may find classes at local art centers, museums, or universities that have metals programs. I teach chain maille classes at Metalwerx, a metal arts school that offers classes, workshops, and studio space for working artists. I hope to see you there!

Metalwerx School for Jewelry and Metal Arts
50 Guinan St.
Waltham, MA 02451
(781) 891-3854
metalwerx.com

JUMP RINGS, TOOLS, AND SUPPLIES

Jewelry supplies are available at bead stores, retail shops, and from online retailers. I encourage you support your local bead shops when possible. Here is a list of some of my favorite online sources for jump rings and jewelry tools and supplies.

CONTENTI
Tools, supplies
515 Narragansett Park Dr.
Pawtucket, RI 02861
(401) 305-3000
contenti.com

FIRE MOUNTAIN GEMS & BEADS
Beads, findings
One Fire Mountain Wy.
Grants Pass, OR 97526
(800) 355-2137
firemountaingems.com

FUSION BEADS
Beads, findings
13024 Stone Ave. N.
Seattle, WA 98133
fusionbeads.com

KINGSLEY NORTH
Tumbling equipment, supplies
910 Brown St.
Norway, MI 49870
(800) 338-9280
kingsleynorth.com

OTTO FREI
Tools, supplies
126 2nd St.
Oakland, CA 94607
(800) 772-3456, ext. 1
ottofrei.com

THE RING LORD
Jump rings, wire
290C RR9
Saskatoon, SK, Canada S7K 1P3
(306) 374-1335
theringlord.com

RIO GRANDE
Jump rings, wire, findings, tools
7500 Bluewater Rd. NW
Albuquerque, NM 87121
(800) 545-6566
riogrande.com

URBAN MAILLE
Jump rings, findings, tools, kits
PO Box 682
Pine, CO 80470
(303) 838-7432
urbanmaille.com

WARG TOOL AND ENAMEL CENTER
Tuff Brake, tools, classes
10 Oak Hill Plaza
Scarborough, ME 04074
(800) 970-9382
wargetc.com

Aspect Ratio Charts

The figures in the following charts are merely mathematical calculations. Differences in manufacturing of actual jump rings are not considered. In addition, as conversions from different measuring systems are made and numbers are rounded, precision is lost. Therefore, the figures contained in these charts are to be used as guidelines for estimation only.

American Wire Gauge (AWG)

10-Gauge Wire (AWG)

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
2.59000	1.00	6.2	0.386100386	0.4
2.59000	1.25	6.4	0.482625483	0.5
2.59000	1.50	6.7	0.579150579	0.6
2.59000	1.75	6.9	0.675675676	0.7
2.59000	2.00	7.2	0.772200772	0.8
2.59000	2.25	7.4	0.868725869	0.9
2.59000	2.50	7.7	0.965250965	1.0
2.59000	2.75	7.9	1.061776062	1.1
2.59000	3.00	8.2	1.158301158	1.2
2.59000	3.25	8.4	1.254826255	1.3
2.59000	3.50	8.7	1.351351351	1.4
2.59000	3.75	8.9	1.447876448	1.4
2.59000	4.00	9.2	1.544401544	1.5
2.59000	4.25	9.4	1.640926641	1.6
2.59000	4.50	9.7	1.737451737	1.7
2.59000	4.75	9.9	1.833976834	1.8
2.59000	5.00	10.2	1.930501931	1.9
2.59000	5.25	10.4	2.027027027	2.0
2.59000	5.50	10.7	2.123552124	2.1
2.59000	5.75	10.9	2.22007722	2.2
2.59000	6.00	11.2	2.316602317	2.3
2.59000	6.25	11.4	2.413127413	2.4
2.59000	6.50	11.7	2.50965251	2.5
2.59000	6.75	11.9	2.606177606	2.6
2.59000	7.00	12.2	2.702702703	2.7
2.59000	7.25	12.4	2.799227799	2.8
2.59000	7.50	12.7	2.895752896	2.9
2.59000	7.75	12.9	2.992277992	3.0
2.59000	8.00	13.2	3.088803089	3.1
2.59000	8.25	13.4	3.185328185	3.2
2.59000	8.50	13.7	3.281853282	3.3
2.59000	8.75	13.9	3.378378378	3.4

10-Gauge Wire (AWG) Cont'd.

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
2.59000	9.00	14.2	3.474903475	3.5
2.59000	9.25	14.4	3.571428571	3.6
2.59000	9.50	14.7	3.667953668	3.7
2.59000	9.75	14.9	3.764478764	3.8
2.59000	10.00	15.2	3.861003861	3.9
2.59000	10.25	15.4	3.957528958	4.0
2.59000	10.50	15.7	4.054054054	4.1
2.59000	10.75	15.9	4.150579151	4.2
2.59000	11.00	16.2	4.247104247	4.2
2.59000	11.25	16.4	4.343629344	4.3
2.59000	11.50	16.7	4.44015444	4.4
2.59000	11.75	16.9	4.536679537	4.5
2.59000	12.00	17.2	4.633204633	4.6
2.59000	13.00	18.2	5.019305019	5.0
2.59000	14.00	19.2	5.405405405	5.4
2.59000	15.00	20.2	5.791505792	5.8
2.59000	16.00	21.2	6.177606178	6.2

12-Gauge Wire (AWG)

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
2.05232	1.00	5.1	0.48725345	0.5
2.05232	1.25	5.4	0.609066812	0.6
2.05232	1.50	5.6	0.730880175	0.7
2.05232	1.75	5.9	0.852693537	0.9
2.05232	2.00	6.1	0.9745069	1.0
2.05232	2.25	6.4	1.096320262	1.1
2.05232	2.50	6.6	1.218133624	1.2
2.05232	2.75	6.9	1.339946987	1.3
2.05232	3.00	7.1	1.461760349	1.5
2.05232	3.25	7.4	1.583573712	1.6

12-Gauge Wire (AWG) Cont'd.

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
2.05232	3.50	7.6	1.705387074	1.7
2.05232	3.75	7.9	1.827200437	1.8
2.05232	4.00	8.1	1.949013799	1.9
2.05232	4.25	8.4	2.070827161	2.1
2.05232	4.50	8.6	2.192640524	2.2
2.05232	4.75	8.9	2.314453886	2.3
2.05232	5.00	9.1	2.436267249	2.4
2.05232	5.25	9.4	2.558080611	2.6
2.05232	5.50	9.6	2.679893974	2.7
2.05232	5.75	9.9	2.801707336	2.8
2.05232	6.00	10.1	2.923520699	2.9
2.05232	6.25	10.4	3.045334061	3.0
2.05232	6.50	10.6	3.167147423	3.2
2.05232	6.75	10.9	3.288960786	3.3
2.05232	7.00	11.1	3.410774148	3.4
2.05232	7.25	11.4	3.532587511	3.5
2.05232	7.50	11.6	3.654400873	3.7
2.05232	7.75	11.9	3.776214236	3.8
2.05232	8.00	12.1	3.898027598	3.9
2.05232	8.25	12.4	4.01984096	4.0
2.05232	8.50	12.6	4.141654323	4.1
2.05232	8.75	12.9	4.263467685	4.3
2.05232	9.00	13.1	4.385281048	4.4
2.05232	9.25	13.4	4.50709441	4.5
2.05232	9.50	13.6	4.628907773	4.6
2.05232	9.75	13.9	4.750721135	4.8
2.05232	10.00	14.1	4.872534498	4.9
2.05232	10.25	14.4	4.99434786	5.0
2.05232	10.50	14.6	5.116161222	5.1
2.05232	10.75	14.9	5.237974585	5.2
2.05232	11.00	15.1	5.359787947	5.4
2.05232	11.25	15.4	5.48160131	5.5
2.05232	11.50	15.6	5.603414672	5.6
2.05232	11.75	15.9	5.725228035	5.7
2.05232	12.00	16.1	5.847041397	5.8
2.05232	13.00	17.1	6.334294847	6.3
2.05232	14.00	18.1	6.821548297	6.8
2.05232	15.00	19.1	7.308801746	7.3
2.05232	16.00	20.1	7.796055196	7.8

14-Gauge Wire (AWG)

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
1.62814	1.00	4.3	0.614197796	0.6
1.62814	1.25	4.5	0.767747245	0.8
1.62814	1.50	4.8	0.921296694	0.9
1.62814	1.75	5.0	1.074846143	1.1
1.62814	2.00	5.3	1.228395593	1.2
1.62814	2.25	5.5	1.381945042	1.4
1.62814	2.50	5.8	1.535494491	1.5
1.62814	2.75	6.0	1.68904394	1.7
1.62814	3.00	6.3	1.842593389	1.8
1.62814	3.25	6.5	1.996142838	2.0
1.62814	3.50	6.8	2.149692287	2.1
1.62814	3.75	7.0	2.303241736	2.3
1.62814	4.00	7.3	2.456791185	2.5
1.62814	4.25	7.5	2.610340634	2.6
1.62814	4.50	7.8	2.763890083	2.8
1.62814	4.75	8.0	2.917439532	2.9
1.62814	5.00	8.3	3.070988981	3.1
1.62814	5.25	8.5	3.22453843	3.2
1.62814	5.50	8.8	3.378087879	3.4
1.62814	5.75	9.0	3.531637328	3.5
1.62814	6.00	9.3	3.685186778	3.7
1.62814	6.25	9.5	3.838736227	3.8
1.62814	6.50	9.8	3.992285676	4.0
1.62814	6.75	10.0	4.145835125	4.1
1.62814	7.00	10.3	4.299384574	4.3
1.62814	7.25	10.5	4.452934023	4.5
1.62814	7.50	10.8	4.606483472	4.6
1.62814	7.75	11.0	4.760032921	4.8
1.62814	8.00	11.3	4.91358237	4.9
1.62814	8.25	11.5	5.067131819	5.1
1.62814	8.50	11.8	5.220681268	5.2
1.62814	8.75	12.0	5.374230717	5.4
1.62814	9.00	12.3	5.527780166	5.5
1.62814	9.25	12.5	5.681329615	5.7
1.62814	9.50	12.8	5.834879064	5.8
1.62814	9.75	13.0	5.988428514	6.0
1.62814	10.00	13.3	6.141977963	6.1
1.62814	10.25	13.5	6.295527412	6.3
1.62814	10.50	13.8	6.449076861	6.4
1.62814	10.75	14.0	6.60262631	6.6
1.62814	11.00	14.3	6.756175759	6.8

14-Gauge Wire (AWG) Cont'd.

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
1.62814	11.25	14.5	6.909725208	6.9
1.62814	11.50	14.8	7.063274657	7.1
1.62814	11.75	15.0	7.216824106	7.2
1.62814	12.00	15.3	7.370373555	7.4
1.62814	13.00	16.3	7.984571351	8.0
1.62814	14.00	17.3	8.598769148	8.6
1.62814	15.00	18.3	9.212966944	9.2
1.62814	16.00	19.3	9.82716474	9.8

16-Gauge Wire (AWG)

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
1.29032	1.00	3.6	0.77500155	0.8
1.29032	1.25	3.8	0.968751938	1.0
1.29032	1.50	4.1	1.162502325	1.2
1.29032	1.75	4.3	1.356252713	1.4
1.29032	2.00	4.6	1.5500031	1.6
1.29032	2.25	4.8	1.743753488	1.7
1.29032	2.50	5.1	1.937503875	1.9
1.29032	2.75	5.3	2.131254263	2.1
1.29032	3.00	5.6	2.32500465	2.3
1.29032	3.25	5.8	2.518755038	2.5
1.29032	3.50	6.1	2.712505425	2.7
1.29032	3.75	6.3	2.906255813	2.9
1.29032	4.00	6.6	3.1000062	3.1
1.29032	4.25	6.8	3.293756588	3.3
1.29032	4.50	7.1	3.487506975	3.5
1.29032	4.75	7.3	3.681257363	3.7
1.29032	5.00	7.6	3.87500775	3.9
1.29032	5.25	7.8	4.068758138	4.1
1.29032	5.50	8.1	4.262508525	4.3
1.29032	5.75	8.3	4.456258913	4.5
1.29032	6.00	8.6	4.6500093	4.7
1.29032	6.25	8.8	4.843759688	4.8
1.29032	6.50	9.1	5.037510075	5.0
1.29032	6.75	9.3	5.231260463	5.2
1.29032	7.00	9.6	5.42501085	5.4
1.29032	7.25	9.8	5.618761238	5.6
1.29032	7.50	10.1	5.812511625	5.8
1.29032	7.75	10.3	6.006262013	6.0

16-Gauge Wire (AWG) Cont'd.

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
1.29032	8.00	10.6	6.2000124	6.2
1.29032	8.25	10.8	6.393762788	6.4
1.29032	8.50	11.1	6.587513175	6.6
1.29032	8.75	11.3	6.781263563	6.8
1.29032	9.00	11.6	6.97501395	7.0
1.29032	9.25	11.8	7.168764338	7.2
1.29032	9.50	12.1	7.362514725	7.4
1.29032	9.75	12.3	7.556265113	7.6
1.29032	10.00	12.6	7.7500155	7.8
1.29032	10.25	12.8	7.943765888	7.9
1.29032	10.50	13.1	8.137516275	8.1
1.29032	10.75	13.3	8.331266663	8.3
1.29032	11.00	13.6	8.52501705	8.5
1.29032	11.25	13.8	8.718767438	8.7
1.29032	11.50	14.1	8.912517825	8.9
1.29032	11.75	14.3	9.106268213	9.1
1.29032	12.00	14.6	9.3000186	9.3
1.29032	13.00	15.6	10.07502015	10.1
1.29032	14.00	16.6	10.8500217	10.9
1.29032	15.00	17.6	11.62502325	11.6
1.29032	16.00	18.6	12.4000248	12.4

18-Gauge Wire (AWG)

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
1.02362	1.00	3.0	0.976925031	1.0
1.02362	1.25	3.3	1.221156288	1.2
1.02362	1.50	3.5	1.465387546	1.5
1.02362	1.75	3.8	1.709618804	1.7
1.02362	2.00	4.0	1.953850062	2.0
1.02362	2.25	4.3	2.198081319	2.2
1.02362	2.50	4.5	2.442312577	2.4
1.02362	2.75	4.8	2.686543835	2.7
1.02362	3.00	5.0	2.930775092	2.9
1.02362	3.25	5.3	3.17500635	3.2
1.02362	3.50	5.5	3.419237608	3.4
1.02362	3.75	5.8	3.663468865	3.7
1.02362	4.00	6.0	3.907700123	3.9
1.02362	4.25	6.3	4.151931381	4.2
1.02362	4.50	6.5	4.396162638	4.4

18-Gauge Wire (AWG) Cont'd.

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
1.02362	4.75	6.8	4.640393896	4.6
1.02362	5.00	7.0	4.884625154	4.9
1.02362	5.25	7.3	5.128856412	5.1
1.02362	5.50	7.5	5.373087669	5.4
1.02362	5.75	7.8	5.617318927	5.6
1.02362	6.00	8.0	5.861550185	5.9
1.02362	6.25	8.3	6.105781442	6.1
1.02362	6.50	8.5	6.3500127	6.4
1.02362	6.75	8.8	6.594243958	6.6
1.02362	7.00	9.0	6.838475215	6.8
1.02362	7.25	9.3	7.082706473	7.1
1.02362	7.50	9.5	7.326937731	7.3
1.02362	7.75	9.8	7.571168988	7.6
1.02362	8.00	10.0	7.815400246	7.8
1.02362	8.25	10.3	8.059631504	8.1
1.02362	8.50	10.5	8.303862762	8.3
1.02362	8.75	10.8	8.548094019	8.5
1.02362	9.00	11.0	8.792325277	8.8
1.02362	9.25	11.3	9.036556535	9.0
1.02362	9.50	11.5	9.280787792	9.3
1.02362	9.75	11.8	9.52501905	9.5
1.02362	10.00	12.0	9.769250308	9.8
1.02362	10.25	12.3	10.01348157	10.0
1.02362	10.50	12.5	10.25771282	10.3
1.02362	10.75	12.8	10.50194408	10.5
1.02362	11.00	13.0	10.74617534	10.7
1.02362	11.25	13.3	10.9904066	11.0
1.02362	11.50	13.5	11.23463785	11.2
1.02362	11.75	13.8	11.47886911	11.5
1.02362	12.00	14.0	11.72310037	11.7
1.02362	13.00	15.0	12.7000254	12.7
1.02362	14.00	16.0	13.67695043	13.7
1.02362	15.00	17.0	14.65387546	14.7
1.02362	16.00	18.0	15.63080049	15.6

20-Gauge Wire (AWG)

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
0.81280	1.00	2.6	1.230314961	1.2
0.81280	1.25	2.9	1.537893701	1.5

20-Gauge Wire (AWG) Cont'd.

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
0.81280	1.50	3.1	1.845472441	1.8
0.81280	1.75	3.4	2.153051181	2.2
0.81280	2.00	3.6	2.460629921	2.5
0.81280	2.25	3.9	2.768208661	2.8
0.81280	2.50	4.1	3.075787402	3.1
0.81280	2.75	4.4	3.383366142	3.4
0.81280	3.00	4.6	3.690944882	3.7
0.81280	3.25	4.9	3.998523622	4.0
0.81280	3.50	5.1	4.306102362	4.3
0.81280	3.75	5.4	4.613681102	4.6
0.81280	4.00	5.6	4.921259843	4.9
0.81280	4.25	5.9	5.228838583	5.2
0.81280	4.50	6.1	5.536417323	5.5
0.81280	4.75	6.4	5.843996063	5.8
0.81280	5.00	6.6	6.151574803	6.2
0.81280	5.25	6.9	6.459153543	6.5
0.81280	5.50	7.1	6.766732283	6.8
0.81280	5.75	7.4	7.074311024	7.1
0.81280	6.00	7.6	7.381889764	7.4
0.81280	6.25	7.9	7.689468504	7.7
0.81280	6.50	8.1	7.997047244	8.0
0.81280	6.75	8.4	8.304625984	8.3
0.81280	7.00	8.6	8.612204724	8.6
0.81280	7.25	8.9	8.919783465	8.9
0.81280	7.50	9.1	9.227362205	9.2
0.81280	7.75	9.4	9.534940945	9.5
0.81280	8.00	9.6	9.842519685	9.8
0.81280	8.25	9.9	10.15009843	10.2
0.81280	8.50	10.1	10.45767717	10.5
0.81280	8.75	10.4	10.76525591	10.8
0.81280	9.00	10.6	11.07283465	11.1
0.81280	9.25	10.9	11.38041339	11.4
0.81280	9.50	11.1	11.68799213	11.7
0.81280	9.75	11.4	11.99557087	12.0
0.81280	10.00	11.6	12.30314961	12.3
0.81280	10.25	11.9	12.61072835	12.6
0.81280	10.50	12.1	12.91830709	12.9
0.81280	10.75	12.4	13.22588583	13.2
0.81280	11.00	12.6	13.53346457	13.5
0.81280	11.25	12.9	13.84104331	13.8
0.81280	11.50	13.1	14.14862205	14.1

20-Gauge Wire (AWG) Cont'd.

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
0.81280	11.75	13.4	14.45620079	14.5
0.81280	12.00	13.6	14.76377953	14.8
0.81280	13.00	14.6	15.99409449	16.0
0.81280	14.00	15.6	17.22440945	17.2
0.81280	15.00	16.6	18.45472441	18.5
0.81280	16.00	17.6	19.68503937	19.7

22-Gauge Wire (AWG)

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
0.64516	1.00	2.3	1.5500031	1.6
0.64516	1.25	2.5	1.937503875	1.9
0.64516	1.50	2.8	2.32500465	2.3
0.64516	1.75	3.0	2.712505425	2.7
0.64516	2.00	3.3	3.1000062	3.1
0.64516	2.25	3.5	3.487506975	3.5
0.64516	2.50	3.8	3.87500775	3.9
0.64516	2.75	4.0	4.262508525	4.3
0.64516	3.00	4.3	4.6500093	4.7
0.64516	3.25	4.5	5.037510075	5.0
0.64516	3.50	4.8	5.42501085	5.4
0.64516	3.75	5.0	5.812511625	5.8
0.64516	4.00	5.3	6.2000124	6.2
0.64516	4.25	5.5	6.587513175	6.6
0.64516	4.50	5.8	6.97501395	7.0
0.64516	4.75	6.0	7.362514725	7.4
0.64516	5.00	6.3	7.7500155	7.8
0.64516	5.25	6.5	8.137516275	8.1
0.64516	5.50	6.8	8.52501705	8.5
0.64516	5.75	7.0	8.912517825	8.9
0.64516	6.00	7.3	9.3000186	9.3
0.64516	6.25	7.5	9.687519375	9.7
0.64516	6.50	7.8	10.07502015	10.1
0.64516	6.75	8.0	10.46252093	10.5
0.64516	7.00	8.3	10.8500217	10.9
0.64516	7.25	8.5	11.23752248	11.2
0.64516	7.50	8.8	11.62502325	11.6
0.64516	7.75	9.0	12.01252403	12.0
0.64516	8.00	9.3	12.4000248	12.4
0.64516	8.25	9.5	12.78752558	12.8

22-Gauge Wire (AWG) Cont'd.

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
0.64516	8.50	9.8	13.17502635	13.2
0.64516	8.75	10.0	13.56252713	13.6
0.64516	9.00	10.3	13.9500279	14.0
0.64516	9.25	10.5	14.33752868	14.3
0.64516	9.50	10.8	14.72502945	14.7
0.64516	9.75	11.0	15.11253023	15.1
0.64516	10.00	11.3	15.500031	15.5
0.64516	10.25	11.5	15.88753178	15.9
0.64516	10.50	11.8	16.27503255	16.3
0.64516	10.75	12.0	16.66253333	16.7
0.64516	11.00	12.3	17.0500341	17.1
0.64516	11.25	12.5	17.43753488	17.4
0.64516	11.50	12.8	17.82503565	17.8
0.64516	11.75	13.0	18.21253643	18.2
0.64516	12.00	13.3	18.6000372	18.6
0.64516	13.00	14.3	20.1500403	20.2
0.64516	14.00	15.3	21.7000434	21.7
0.64516	15.00	16.3	23.2500465	23.3
0.64516	16.00	17.3	24.8000496	24.8

24-Gauge Wire (AWG)

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
0.50800	1.00	2.0	1.968503937	2.0
0.50800	1.25	2.3	2.460629921	2.5
0.50800	1.50	2.5	2.952755906	3.0
0.50800	1.75	2.8	3.44488189	3.4
0.50800	2.00	3.0	3.937007874	3.9
0.50800	2.25	3.3	4.429133858	4.4
0.50800	2.50	3.5	4.921259843	4.9
0.50800	2.75	3.8	5.413385827	5.4
0.50800	3.00	4.0	5.905511811	5.9
0.50800	3.25	4.3	6.397637795	6.4
0.50800	3.50	4.5	6.88976378	6.9
0.50800	3.75	4.8	7.381889764	7.4
0.50800	4.00	5.0	7.874015748	7.9
0.50800	4.25	5.3	8.366141732	8.4
0.50800	4.50	5.5	8.858267717	8.9
0.50800	4.75	5.8	9.350393701	9.4
0.50800	5.00	6.0	9.842519685	9.8

24-Gauge Wire (AWG) Cont'd.

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
0.50800	5.25	6.3	10.33464567	10.3
0.50800	5.50	6.5	10.82677165	10.8
0.50800	5.75	6.8	11.31889764	11.3
0.50800	6.00	7.0	11.81102362	11.8
0.50800	6.25	7.3	12.30314961	12.3
0.50800	6.50	7.5	12.79527559	12.8
0.50800	6.75	7.8	13.28740157	13.3
0.50800	7.00	8.0	13.77952756	13.8
0.50800	7.25	8.3	14.27165354	14.3
0.50800	7.50	8.5	14.76377953	14.8
0.50800	7.75	8.8	15.25590551	15.3
0.50800	8.00	9.0	15.7480315	15.7
0.50800	8.25	9.3	16.24015748	16.2
0.50800	8.50	9.5	16.73228346	16.7
0.50800	8.75	9.8	17.22440945	17.2
0.50800	9.00	10.0	17.71653543	17.7

24-Gauge Wire (AWG) Cont'd.

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
0.50800	9.25	10.3	18.20866142	18.2
0.50800	9.50	10.5	18.7007874	18.7
0.50800	9.75	10.8	19.19291339	19.2
0.50800	10.00	11.0	19.68503937	19.7
0.50800	10.25	11.3	20.17716535	20.2
0.50800	10.50	11.5	20.66929134	20.7
0.50800	10.75	11.8	21.16141732	21.2
0.50800	11.00	12.0	21.65354331	21.7
0.50800	11.25	12.3	22.14566929	22.1
0.50800	11.50	12.5	22.63779528	22.6
0.50800	11.75	12.8	23.12992126	23.1
0.50800	12.00	13.0	23.62204724	23.6
0.50800	13.00	14.0	25.59055118	25.6
0.50800	14.00	15.0	27.55905512	27.6
0.50800	15.00	16.0	29.52755906	29.5
0.50800	16.00	17.0	31.49606299	31.5

British Standard Wire Gauge (SWG)

10-Gauge Wire (SWG)

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
3.25000	1.00	7.5	0.307692308	0.3
3.25000	1.25	7.8	0.384615385	0.4
3.25000	1.50	8.0	0.461538462	0.5
3.25000	1.75	8.3	0.538461538	0.5
3.25000	2.00	8.5	0.615384615	0.6
3.25000	2.25	8.8	0.692307692	0.7
3.25000	2.50	9.0	0.769230769	0.8
3.25000	2.75	9.3	0.846153846	0.8
3.25000	3.00	9.5	0.923076923	0.9
3.25000	3.25	9.8	1	1.0
3.25000	3.50	10.0	1.076923077	1.1
3.25000	3.75	10.3	1.153846154	1.2
3.25000	4.00	10.5	1.230769231	1.2
3.25000	4.25	10.8	1.307692308	1.3
3.25000	4.50	11.0	1.384615385	1.4
3.25000	4.75	11.3	1.461538462	1.5

10-Gauge Wire (SWG) Cont'd.

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
3.25000	5.00	11.5	1.538461538	1.5
3.25000	5.25	11.8	1.615384615	1.6
3.25000	5.50	12.0	1.692307692	1.7
3.25000	5.75	12.3	1.769230769	1.8
3.25000	6.00	12.5	1.846153846	1.8
3.25000	6.25	12.8	1.923076923	1.9
3.25000	6.50	13.0	2	2.0
3.25000	6.75	13.3	2.076923077	2.1
3.25000	7.00	13.5	2.153846154	2.2
3.25000	7.25	13.8	2.230769231	2.2
3.25000	7.50	14.0	2.307692308	2.3
3.25000	7.75	14.3	2.384615385	2.4
3.25000	8.00	14.5	2.461538462	2.5
3.25000	8.25	14.8	2.538461538	2.5
3.25000	8.50	15.0	2.615384615	2.6
3.25000	8.75	15.3	2.692307692	2.7

10-Gauge Wire (SWG) Cont'd.

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
3.25000	9.00	15.5	2.769230769	2.8
3.25000	9.25	15.8	2.846153846	2.8
3.25000	9.50	16.0	2.923076923	2.9
3.25000	9.75	16.3	3	3.0
3.25000	10.00	16.5	3.076923077	3.1
3.25000	10.25	16.8	3.153846154	3.2
3.25000	10.50	17.0	3.230769231	3.2
3.25000	10.75	17.3	3.307692308	3.3
3.25000	11.00	17.5	3.384615385	3.4
3.25000	11.25	17.8	3.461538462	3.5
3.25000	11.50	18.0	3.538461538	3.5
3.25000	11.75	18.3	3.615384615	3.6
3.25000	12.00	18.5	3.692307692	3.7
3.25000	13.00	19.5	4	4.0
3.25000	14.00	20.5	4.307692308	4.3
3.25000	15.00	21.5	4.615384615	4.6
3.25000	16.00	22.5	4.923076923	4.9

12-Gauge Wire (SWG)

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
2.64000	1.00	6.3	0.378787879	0.4
2.64000	1.25	6.5	0.473484848	0.5
2.64000	1.50	6.8	0.568181818	0.6
2.64000	1.75	7.0	0.662878788	0.7
2.64000	2.00	7.3	0.757575758	0.8
2.64000	2.25	7.5	0.852272727	0.9
2.64000	2.50	7.8	0.946969697	0.9
2.64000	2.75	8.0	1.041666667	1.0
2.64000	3.00	8.3	1.136363636	1.1
2.64000	3.25	8.5	1.231060606	1.2
2.64000	3.50	8.8	1.325757576	1.3
2.64000	3.75	9.0	1.420454545	1.4
2.64000	4.00	9.3	1.515151515	1.5
2.64000	4.25	9.5	1.609848485	1.6
2.64000	4.50	9.8	1.704545455	1.7
2.64000	4.75	10.0	1.799242424	1.8
2.64000	5.00	10.3	1.893939394	1.9
2.64000	5.25	10.5	1.988636364	2.0
2.64000	5.50	10.8	2.083333333	2.1

12-Gauge Wire (SWG) Cont'd.

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
2.64000	5.75	11.0	2.178030303	2.2
2.64000	6.00	11.3	2.272727273	2.3
2.64000	6.25	11.5	2.367424242	2.4
2.64000	6.50	11.8	2.462121212	2.5
2.64000	6.75	12.0	2.556818182	2.6
2.64000	7.00	12.3	2.651515152	2.7
2.64000	7.25	12.5	2.746212121	2.7
2.64000	7.50	12.8	2.840909091	2.8
2.64000	7.75	13.0	2.935606061	2.9
2.64000	8.00	13.3	3.03030303	3.0
2.64000	8.25	13.5	3.125	3.1
2.64000	8.50	13.8	3.21969697	3.2
2.64000	8.75	14.0	3.314393939	3.3
2.64000	9.00	14.3	3.409090909	3.4
2.64000	9.25	14.5	3.503787879	3.5
2.64000	9.50	14.8	3.598484848	3.6
2.64000	9.75	15.0	3.693181818	3.7
2.64000	10.00	15.3	3.787878788	3.8
2.64000	10.25	15.5	3.882575758	3.9
2.64000	10.50	15.8	3.977272727	4.0
2.64000	10.75	16.0	4.071969697	4.1
2.64000	11.00	16.3	4.166666667	4.2
2.64000	11.25	16.5	4.261363636	4.3
2.64000	11.50	16.8	4.356060606	4.4
2.64000	11.75	17.0	4.450757576	4.5
2.64000	12.00	17.3	4.545454545	4.5
2.64000	13.00	18.3	4.924242424	4.9
2.64000	14.00	19.3	5.303030303	5.3
2.64000	15.00	20.3	5.681818182	5.7
2.64000	16.00	21.3	6.060606061	6.1

14-Gauge Wire (SWG)

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
2.03000	1.00	5.1	0.492610837	0.5
2.03000	1.25	5.3	0.615763547	0.6
2.03000	1.50	5.6	0.738916256	0.7
2.03000	1.75	5.8	0.862068966	0.9
2.03000	2.00	6.1	0.985221675	1.0
2.03000	2.25	6.3	1.108374384	1.1

14-Gauge Wire (SWG) Cont'd.

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
2.03000	2.50	6.6	1.231527094	1.2
2.03000	2.75	6.8	1.354679803	1.4
2.03000	3.00	7.1	1.477832512	1.5
2.03000	3.25	7.3	1.600985222	1.6
2.03000	3.50	7.6	1.724137931	1.7
2.03000	3.75	7.8	1.84729064	1.8
2.03000	4.00	8.1	1.97044335	2.0
2.03000	4.25	8.3	2.093596059	2.1
2.03000	4.50	8.6	2.216748768	2.2
2.03000	4.75	8.8	2.339901478	2.3
2.03000	5.00	9.1	2.463054187	2.5
2.03000	5.25	9.3	2.586206897	2.6
2.03000	5.50	9.6	2.709359606	2.7
2.03000	5.75	9.8	2.832512315	2.8
2.03000	6.00	10.1	2.955665025	3.0
2.03000	6.25	10.3	3.078817734	3.1
2.03000	6.50	10.6	3.201970443	3.2
2.03000	6.75	10.8	3.325123153	3.3
2.03000	7.00	11.1	3.448275862	3.4
2.03000	7.25	11.3	3.571428571	3.6
2.03000	7.50	11.6	3.694581281	3.7
2.03000	7.75	11.8	3.81773399	3.8
2.03000	8.00	12.1	3.9408867	3.9
2.03000	8.25	12.3	4.064039409	4.1
2.03000	8.50	12.6	4.187192118	4.2
2.03000	8.75	12.8	4.310344828	4.3
2.03000	9.00	13.1	4.433497537	4.4
2.03000	9.25	13.3	4.556650246	4.6
2.03000	9.50	13.6	4.679802956	4.7
2.03000	9.75	13.8	4.802955665	4.8
2.03000	10.00	14.1	4.926108374	4.9
2.03000	10.25	14.3	5.049261084	5.0
2.03000	10.50	14.6	5.172413793	5.2
2.03000	10.75	14.8	5.295566502	5.3
2.03000	11.00	15.1	5.418719212	5.4
2.03000	11.25	15.3	5.541871921	5.5
2.03000	11.50	15.6	5.665024631	5.7
2.03000	11.75	15.8	5.78817734	5.8
2.03000	12.00	16.1	5.911330049	5.9
2.03000	13.00	17.1	6.403940887	6.4
2.03000	14.00	18.1	6.896551724	6.9

14-Gauge Wire (SWG) Cont'd.

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
2.03000	15.00	19.1	7.389162562	7.4
2.03000	16.00	20.1	7.881773399	7.9

16-Gauge Wire (SWG)

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
1.63000	1.00	4.3	0.613496933	0.6
1.63000	1.25	4.5	0.766871166	0.8
1.63000	1.50	4.8	0.920245399	0.9
1.63000	1.75	5.0	1.073619632	1.1
1.63000	2.00	5.3	1.226993865	1.2
1.63000	2.25	5.5	1.380368098	1.4
1.63000	2.50	5.8	1.533742331	1.5
1.63000	2.75	6.0	1.687116564	1.7
1.63000	3.00	6.3	1.840490798	1.8
1.63000	3.25	6.5	1.993865031	2.0
1.63000	3.50	6.8	2.147239264	2.1
1.63000	3.75	7.0	2.300613497	2.3
1.63000	4.00	7.3	2.45398773	2.5
1.63000	4.25	7.5	2.607361963	2.6
1.63000	4.50	7.8	2.760736196	2.8
1.63000	4.75	8.0	2.914110429	2.9
1.63000	5.00	8.3	3.067484663	3.1
1.63000	5.25	8.5	3.220858896	3.2
1.63000	5.50	8.8	3.374233129	3.4
1.63000	5.75	9.0	3.527607362	3.5
1.63000	6.00	9.3	3.680981595	3.7
1.63000	6.25	9.5	3.834355828	3.8
1.63000	6.50	9.8	3.987730061	4.0
1.63000	6.75	10.0	4.141104294	4.1
1.63000	7.00	10.3	4.294478528	4.3
1.63000	7.25	10.5	4.447852761	4.4
1.63000	7.50	10.8	4.601226994	4.6
1.63000	7.75	11.0	4.754601227	4.8
1.63000	8.00	11.3	4.90797546	4.9
1.63000	8.25	11.5	5.061349693	5.1
1.63000	8.50	11.8	5.214723926	5.2
1.63000	8.75	12.0	5.36809816	5.4
1.63000	9.00	12.3	5.521472393	5.5
1.63000	9.25	12.5	5.674846626	5.7

16-Gauge Wire (SWG) Cont'd.

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
1.63000	9.50	12.8	5.828220859	5.8
1.63000	9.75	13.0	5.981595092	6.0
1.63000	10.00	13.3	6.134969325	6.1
1.63000	10.25	13.5	6.288343558	6.3
1.63000	10.50	13.8	6.441717791	6.4
1.63000	10.75	14.0	6.595092025	6.6
1.63000	11.00	14.3	6.748466258	6.7
1.63000	11.25	14.5	6.901840491	6.9
1.63000	11.50	14.8	7.055214724	7.1
1.63000	11.75	15.0	7.208588957	7.2
1.63000	12.00	15.3	7.36196319	7.4
1.63000	13.00	16.3	7.975460123	8.0
1.63000	14.00	17.3	8.588957055	8.6
1.63000	15.00	18.3	9.202453988	9.2
1.63000	16.00	19.3	9.81595092	9.8

18-Gauge Wire (SWG)

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
1.22000	1.00	3.4	0.819672131	0.8
1.22000	1.25	3.7	1.024590164	1.0
1.22000	1.50	3.9	1.229508197	1.2
1.22000	1.75	4.2	1.43442623	1.4
1.22000	2.00	4.4	1.639344262	1.6
1.22000	2.25	4.7	1.844262295	1.8
1.22000	2.50	4.9	2.049180328	2.0
1.22000	2.75	5.2	2.254098361	2.3
1.22000	3.00	5.4	2.459016393	2.5
1.22000	3.25	5.7	2.663934426	2.7
1.22000	3.50	5.9	2.868852459	2.9
1.22000	3.75	6.2	3.073770492	3.1
1.22000	4.00	6.4	3.278688525	3.3
1.22000	4.25	6.7	3.483606557	3.5
1.22000	4.50	6.9	3.68852459	3.7
1.22000	4.75	7.2	3.893442623	3.9
1.22000	5.00	7.4	4.098360656	4.1
1.22000	5.25	7.7	4.303278689	4.3
1.22000	5.50	7.9	4.508196721	4.5
1.22000	5.75	8.2	4.713114754	4.7
1.22000	6.00	8.4	4.918032787	4.9

18-Gauge Wire (SWG) Cont'd.

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
1.22000	6.25	8.7	5.12295082	5.1
1.22000	6.50	8.9	5.327868852	5.3
1.22000	6.75	9.2	5.532786885	5.5
1.22000	7.00	9.4	5.737704918	5.7
1.22000	7.25	9.7	5.942622951	5.9
1.22000	7.50	9.9	6.147540984	6.1
1.22000	7.75	10.2	6.352459016	6.4
1.22000	8.00	10.4	6.557377049	6.6
1.22000	8.25	10.7	6.762295082	6.8
1.22000	8.50	10.9	6.967213115	7.0
1.22000	8.75	11.2	7.172131148	7.2
1.22000	9.00	11.4	7.37704918	7.4
1.22000	9.25	11.7	7.581967213	7.6
1.22000	9.50	11.9	7.786885246	7.8
1.22000	9.75	12.2	7.991803279	8.0
1.22000	10.00	12.4	8.196721311	8.2
1.22000	10.25	12.7	8.401639344	8.4
1.22000	10.50	12.9	8.606557377	8.6
1.22000	10.75	13.2	8.81147541	8.8
1.22000	11.00	13.4	9.016393443	9.0
1.22000	11.25	13.7	9.221311475	9.2
1.22000	11.50	13.9	9.426229508	9.4
1.22000	11.75	14.2	9.631147541	9.6
1.22000	12.00	14.4	9.836065574	9.8
1.22000	13.00	15.4	10.6557377	10.7
1.22000	14.00	16.4	11.47540984	11.5
1.22000	15.00	17.4	12.29508197	12.3
1.22000	16.00	18.4	13.1147541	13.1

20-Gauge Wire (SWG)

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
0.91400	1.00	2.8	1.094091904	1.1
0.91400	1.25	3.1	1.36761488	1.4
0.91400	1.50	3.3	1.641137856	1.6
0.91400	1.75	3.6	1.914660832	1.9
0.91400	2.00	3.8	2.188183807	2.2
0.91400	2.25	4.1	2.461706783	2.5
0.91400	2.50	4.3	2.735229759	2.7
0.91400	2.75	4.6	3.008752735	3.0

20-Gauge Wire (SWG) Cont'd.

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
0.91400	3.00	4.8	3.282275711	3.3
0.91400	3.25	5.1	3.555798687	3.6
0.91400	3.50	5.3	3.829321663	3.8
0.91400	3.75	5.6	4.102844639	4.1
0.91400	4.00	5.8	4.376367615	4.4
0.91400	4.25	6.1	4.649890591	4.6
0.91400	4.50	6.3	4.923413567	4.9
0.91400	4.75	6.6	5.196936543	5.2
0.91400	5.00	6.8	5.470459519	5.5
0.91400	5.25	7.1	5.743982495	5.7
0.91400	5.50	7.3	6.01750547	6.0
0.91400	5.75	7.6	6.291028446	6.3
0.91400	6.00	7.8	6.564551422	6.6
0.91400	6.25	8.1	6.838074398	6.8
0.91400	6.50	8.3	7.111597374	7.1
0.91400	6.75	8.6	7.38512035	7.4
0.91400	7.00	8.8	7.658643326	7.7
0.91400	7.25	9.1	7.932166302	7.9
0.91400	7.50	9.3	8.205689278	8.2
0.91400	7.75	9.6	8.479212254	8.5
0.91400	8.00	9.8	8.75273523	8.8
0.91400	8.25	10.1	9.026258206	9.0
0.91400	8.50	10.3	9.299781182	9.3
0.91400	8.75	10.6	9.573304158	9.6
0.91400	9.00	10.8	9.846827133	9.8
0.91400	9.25	11.1	10.12035011	10.1
0.91400	9.50	11.3	10.39387309	10.4
0.91400	9.75	11.6	10.66739606	10.7
0.91400	10.00	11.8	10.94091904	10.9
0.91400	10.25	12.1	11.21444201	11.2
0.91400	10.50	12.3	11.48796499	11.5
0.91400	10.75	12.6	11.76148796	11.8
0.91400	11.00	12.8	12.03501094	12.0
0.91400	11.25	13.1	12.30853392	12.3
0.91400	11.50	13.3	12.58205689	12.6
0.91400	11.75	13.6	12.85557987	12.9
0.91400	12.00	13.8	13.12910284	13.1
0.91400	13.00	14.8	14.22319475	14.2
0.91400	14.00	15.8	15.31728665	15.3
0.91400	15.00	16.8	16.41137856	16.4
0.91400	16.00	17.8	17.50547046	17.5

22-Gauge Wire (SWG)

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
0.71100	1.00	2.4	1.406469761	1.4
0.71100	1.25	2.7	1.758087201	1.8
0.71100	1.50	2.9	2.109704641	2.1
0.71100	1.75	3.2	2.461322082	2.5
0.71100	2.00	3.4	2.812939522	2.8
0.71100	2.25	3.7	3.164556962	3.2
0.71100	2.50	3.9	3.516174402	3.5
0.71100	2.75	4.2	3.867791842	3.9
0.71100	3.00	4.4	4.219409283	4.2
0.71100	3.25	4.7	4.571026723	4.6
0.71100	3.50	4.9	4.922644163	4.9
0.71100	3.75	5.2	5.274261603	5.3
0.71100	4.00	5.4	5.625879044	5.6
0.71100	4.25	5.7	5.977496484	6.0
0.71100	4.50	5.9	6.329113924	6.3
0.71100	4.75	6.2	6.680731364	6.7
0.71100	5.00	6.4	7.032348805	7.0
0.71100	5.25	6.7	7.383966245	7.4
0.71100	5.50	6.9	7.735583685	7.7
0.71100	5.75	7.2	8.087201125	8.1
0.71100	6.00	7.4	8.438818565	8.4
0.71100	6.25	7.7	8.790436006	8.8
0.71100	6.50	7.9	9.142053446	9.1
0.71100	6.75	8.2	9.493670886	9.5
0.71100	7.00	8.4	9.845288326	9.8
0.71100	7.25	8.7	10.19690577	10.2
0.71100	7.50	8.9	10.54852321	10.5
0.71100	7.75	9.2	10.90014065	10.9
0.71100	8.00	9.4	11.25175809	11.3
0.71100	8.25	9.7	11.60337553	11.6
0.71100	8.50	9.9	11.95499297	12.0
0.71100	8.75	10.2	12.30661041	12.3
0.71100	9.00	10.4	12.65822785	12.7
0.71100	9.25	10.7	13.00984529	13.0
0.71100	9.50	10.9	13.36146273	13.4
0.71100	9.75	11.2	13.71308017	13.7
0.71100	10.00	11.4	14.06469761	14.1
0.71100	10.25	11.7	14.41631505	14.4
0.71100	10.50	11.9	14.76793249	14.8
0.71100	10.75	12.2	15.11954993	15.1
0.71100	11.00	12.4	15.47116737	15.5

22-Gauge Wire (SWG) Cont'd.

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
0.71100	11.25	12.7	15.82278481	15.8
0.71100	11.50	12.9	16.17440225	16.2
0.71100	11.75	13.2	16.52601969	16.5
0.71100	12.00	13.4	16.87763713	16.9
0.71100	13.00	14.4	18.28410689	18.3
0.71100	14.00	15.4	19.69057665	19.7
0.71100	15.00	16.4	21.09704641	21.1
0.71100	16.00	17.4	22.50351617	22.5

24-Gauge Wire (SWG)

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
0.55900	1.00	2.1	1.788908766	1.8
0.55900	1.25	2.4	2.236135957	2.2
0.55900	1.50	2.6	2.683363148	2.7
0.55900	1.75	2.9	3.13059034	3.1
0.55900	2.00	3.1	3.577817531	3.6
0.55900	2.25	3.4	4.025044723	4.0
0.55900	2.50	3.6	4.472271914	4.5
0.55900	2.75	3.9	4.919499106	4.9
0.55900	3.00	4.1	5.366726297	5.4
0.55900	3.25	4.4	5.813953488	5.8
0.55900	3.50	4.6	6.26118068	6.3
0.55900	3.75	4.9	6.708407871	6.7
0.55900	4.00	5.1	7.155635063	7.2
0.55900	4.25	5.4	7.602862254	7.6
0.55900	4.50	5.6	8.050089445	8.1
0.55900	4.75	5.9	8.497316637	8.5
0.55900	5.00	6.1	8.944543828	8.9
0.55900	5.25	6.4	9.39177102	9.4
0.55900	5.50	6.6	9.838998211	9.8
0.55900	5.75	6.9	10.2862254	10.3
0.55900	6.00	7.1	10.73345259	10.7
0.55900	6.25	7.4	11.18067979	11.2
0.55900	6.50	7.6	11.62790698	11.6
0.55900	6.75	7.9	12.07513417	12.1
0.55900	7.00	8.1	12.52236136	12.5
0.55900	7.25	8.4	12.96958855	13.0
0.55900	7.50	8.6	13.41681574	13.4
0.55900	7.75	8.9	13.86404293	13.9

24-Gauge Wire (SWG) Cont'd.

WD (MM)	ID (MM)	OD (MM)	AR	ROUNDED (MM)
0.55900	8.00	9.1	14.31127013	14.3
0.55900	8.25	9.4	14.75849732	14.8
0.55900	8.50	9.6	15.20572451	15.2
0.55900	8.75	9.9	15.6529517	15.7
0.55900	9.00	10.1	16.10017889	16.1
0.55900	9.25	10.4	16.54740608	16.5
0.55900	9.50	10.6	16.99463327	17.0
0.55900	9.75	10.9	17.44186047	17.4
0.55900	10.00	11.1	17.88908766	17.9
0.55900	10.25	11.4	18.33631485	18.3
0.55900	10.50	11.6	18.78354204	18.8
0.55900	10.75	11.9	19.23076923	19.2
0.55900	11.00	12.1	19.67799642	19.7
0.55900	11.25	12.4	20.12522361	20.1
0.55900	11.50	12.6	20.57245081	20.6
0.55900	11.75	12.9	21.019678	21.0
0.55900	12.00	13.1	21.46690519	21.5
0.55900	13.00	14.1	23.25581395	23.3
0.55900	14.00	15.1	25.04472272	25.0
0.55900	15.00	16.1	26.83363148	26.8
0.55900	16.00	17.1	28.62254025	28.6

Imperial and Metric Conversion Charts

When determining aspect ratio, you may need to convert a fractional measurement to its metric equivalent before working through your calculations. For example, to determine the aspect ratio for a SWG 16g 7/32" jump ring, I would use the Inches to Millimeters chart to find the metric equivalent for 7/32: 5.56 mm.

Then I would use the 16-Gauge Wire (SWG) aspect ratio chart to find the closest inner diameter to that measurement: 5.50 mm or 5.75 mm. Again using the chart, I now know that my ideal aspect ratio lies somewhere in between 3.4 and 3.5.

Inches to Millimeters

64THS	FRACTION	CONVERSION	MM
1	1/64	25.4	0.40
2	1/32	25.4	0.79
3	3/64	25.4	1.19
4	1/16	25.4	1.59
5	5/64	25.4	1.98
6	3/32	25.4	2.38
7	7/64	25.4	2.78
8	1/8	25.4	3.18
9	9/64	25.4	3.57
10	5/32	25.4	3.97
11	11/64	25.4	4.37
12	3/16	25.4	4.76
13	13/64	25.4	5.16
14	7/32	25.4	5.56
15	15/64	25.4	5.95
16	1/4	25.4	6.35
17	17/64	25.4	6.75
18	9/32	25.4	7.14
19	19/64	25.4	7.54
20	5/16	25.4	7.94
21	21/64	25.4	8.33
22	11/32	25.4	8.73
23	23/64	25.4	9.13
24	3/8	25.4	9.53
25	25/64	25.4	9.92
26	13/32	25.4	10.32
27	27/64	25.4	10.72
28	7/16	25.4	11.11
29	29/64	25.4	11.51
30	15/32	25.4	11.91
31	31/64	25.4	12.30
32	1/2	25.4	12.70

Inches to Millimeters Cont'd.

64THS	FRACTION	CONVERSION	MM
33	33/64	25.4	13.10
34	17/32	25.4	13.49
35	35/64	25.4	13.89
36	9/16	25.4	14.29
37	37/64	25.4	14.68
38	19/32	25.4	15.08
39	39/64	25.4	15.48
40	5/8	25.4	15.88
41	41/64	25.4	16.27
42	21/32	25.4	16.67
43	43/64	25.4	17.07
44	11/16	25.4	17.46
45	45/64	25.4	17.86
46	23/32	25.4	18.26
47	47/64	25.4	18.65
48	3/4	25.4	19.05
49	49/64	25.4	19.45
50	25/32	25.4	19.84
51	51/64	25.4	20.24
52	13/16	25.4	20.64
53	53/64	25.4	21.03
54	27/32	25.4	21.43
55	55/64	25.4	21.83
56	7/8	25.4	22.23
57	57/64	25.4	22.62
58	29/32	25.4	23.02
59	59/64	25.4	23.42
60	15/16	25.4	23.81
61	61/64	25.4	24.21
62	31/32	25.4	24.61
63	63/64	25.4	25.00
64	1	25.4	25.40

Millimeters to Inches

MM	CONVERSION	INCHES	
		Fraction	Decimal
0.10	25.4	0	0.0039
0.20	25.4	0	0.0079
0.30	25.4	1/85	0.0118
0.40	25.4	1/63	0.0157
0.50	25.4	1/51	0.0197
0.60	25.4	2/85	0.0236
0.70	25.4	1/36	0.0276
0.80	25.4	3/95	0.0315
0.90	25.4	1/28	0.0354
1.00	25.4	3/76	0.0394
1.10	25.4	1/23	0.0433
1.20	25.4	1/21	0.0472
1.30	25.4	2/39	0.0512
1.40	25.4	1/18	0.0551
1.50	25.4	1/17	0.0591
1.60	25.4	1/16	0.0630
1.70	25.4	1/15	0.0669
1.80	25.4	1/14	0.0709
1.90	25.4	3/40	0.0748
2.00	25.4	3/38	0.0787
2.10	25.4	1/12	0.0827
2.20	25.4	2/23	0.0866
2.30	25.4	1/11	0.0906
2.40	25.4	5/53	0.0945
2.50	25.4	6/61	0.0984
2.60	25.4	4/39	0.1024
2.70	25.4	5/47	0.1063
2.80	25.4	1/9	0.1102
2.90	25.4	4/35	0.1142
3.00	25.4	2/17	0.1181
3.10	25.4	5/41	0.1220
3.20	25.4	1/8	0.1260
3.30	25.4	10/77	0.1299
3.40	25.4	2/15	0.1339
3.50	25.4	4/29	0.1378
3.60	25.4	1/7	0.1417

Millimeters to Inches Cont'd.

MM	CONVERSION	INCHES	
		Fraction	Decimal
3.70	25.4	7/48	0.1457
3.80	25.4	3/20	0.1496
3.90	25.4	2/13	0.1535
4.00	25.4	3/19	0.1575
4.10	25.4	5/31	0.1614
4.20	25.4	1/6	0.1654
4.30	25.4	11/65	0.1693
4.40	25.4	13/75	0.1732
4.50	25.4	14/79	0.1772
4.60	25.4	2/11	0.1811
4.70	25.4	5/27	0.1850
4.80	25.4	17/90	0.1890
4.90	25.4	11/57	0.1929
5.00	25.4	12/61	0.1969
5.10	25.4	1/5	0.2008
5.20	25.4	17/83	0.2047
5.30	25.4	5/24	0.2087
5.40	25.4	10/47	0.2126
5.50	25.4	21/97	0.2165
5.60	25.4	15/68	0.2205
5.70	25.4	11/49	0.2244
5.80	25.4	21/92	0.2283
5.90	25.4	23/99	0.2323
6.00	25.4	13/55	0.2362
6.10	25.4	6/25	0.2402
6.20	25.4	21/86	0.2441
6.30	25.4	1/4	0.2480
6.40	25.4	1/4	0.2520
6.50	25.4	11/43	0.2559
6.60	25.4	20/77	0.2598
6.70	25.4	24/91	0.2638
6.80	25.4	15/56	0.2677
6.90	25.4	22/81	0.2717
7.00	25.4	8/29	0.2756
7.10	25.4	26/93	0.2795
7.20	25.4	19/67	0.2835

Millimeters to Inches Cont'd.

MM	CONVERSION	INCHES	
		Fraction	Decimal
7.30	25.4	25/87	0.2874
7.40	25.4	7/24	0.2913
7.50	25.4	13/44	0.2953
7.60	25.4	3/10	0.2992
7.70	25.4	10/33	0.3031
7.80	25.4	4/13	0.3071
7.90	25.4	14/45	0.3110
8.00	25.4	23/73	0.3150
8.10	25.4	22/69	0.3189
8.20	25.4	10/31	0.3228
8.30	25.4	17/52	0.3268
8.40	25.4	1/3	0.3307
8.50	25.4	1/3	0.3346
8.60	25.4	21/62	0.3386
8.70	25.4	25/73	0.3425
8.80	25.4	9/26	0.3465
8.90	25.4	7/20	0.3504
9.00	25.4	28/79	0.3543
9.10	25.4	24/67	0.3583
9.20	25.4	21/58	0.3622
9.30	25.4	26/71	0.3661
9.40	25.4	10/27	0.3701
9.50	25.4	3/8	0.3740
9.60	25.4	17/45	0.3780
9.70	25.4	21/55	0.3819
9.80	25.4	22/57	0.3858
9.90	25.4	23/59	0.3898
10.00	25.4	37/94	0.3937
10.10	25.4	33/83	0.3976
10.20	25.4	2/5	0.4016
10.30	25.4	15/37	0.4055
10.40	25.4	9/22	0.4094
10.50	25.4	31/75	0.4134
10.60	25.4	5/12	0.4173
10.70	25.4	8/19	0.4213
10.80	25.4	37/87	0.4252
10.90	25.4	3/7	0.4291
11.00	25.4	13/30	0.4331
11.10	25.4	7/16	0.4370
11.20	25.4	15/34	0.4409

Millimeters to Inches Cont'd.

MM	CONVERSION	INCHES	
		Fraction	Decimal
11.30	25.4	4/9	0.4449
11.40	25.4	22/49	0.4488
11.50	25.4	24/53	0.4528
11.60	25.4	21/46	0.4567
11.70	25.4	41/89	0.4606
11.80	25.4	46/99	0.4646
11.90	25.4	15/32	0.4685
12.00	25.4	43/91	0.4724
12.10	25.4	10/21	0.4764
12.20	25.4	12/25	0.4803
12.30	25.4	46/95	0.4843
12.40	25.4	21/43	0.4882
12.50	25.4	31/63	0.4921
12.60	25.4	1/2	0.4961
12.70	25.4	1/2	0.5000
12.80	25.4	1/2	0.5039
12.90	25.4	32/63	0.5079
13.00	25.4	22/43	0.5118
13.10	25.4	49/95	0.5157
13.20	25.4	13/25	0.5197

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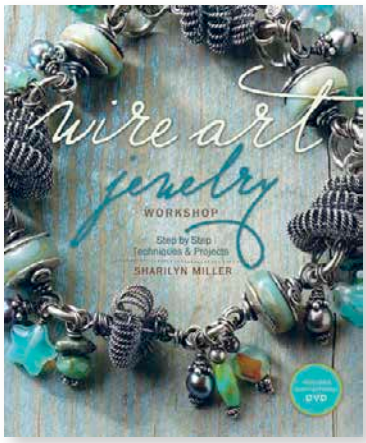

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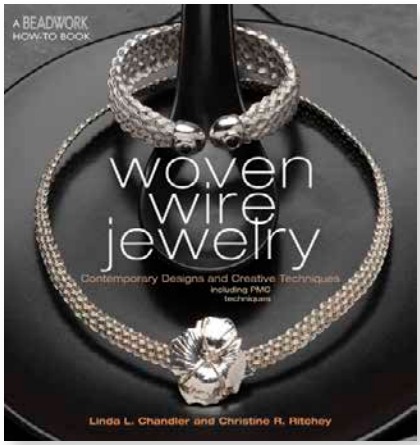

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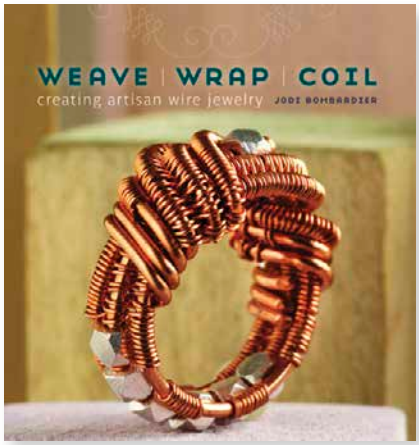

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